UBC Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Transitioning Towards a Climate-Friendly Food System at UBC

Niku Buchheister, Kristy Ip, Anita Koralewicz, Jasmine Bal, Aleksandra Stefankowski

University of British Columbia

Course: LFS 450

Themes: Climate, Food, Procurement

Date: April 16, 2020

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Executive Summary

We are all connected by our need for food, water, and shelter. Earth's ability to continue to provide these services is at risk due to current greenhouse gas (GHG) emission levels associated with consumption and production of commodities and associated shifts in the global climate (IPCC, 2018). Approximately 25 percent of global GHG emissions (GHGe) come from the agri-food sector (FAO, 2019). Creating a climate-friendly food system (CFFS) is integral in lowering anthropogenic emissions and thereby mitigating climate change while also supporting a more food-secure future. The University of British Columbia (UBC) announced a Climate Emergency Declaration in December 2019, joining a network of over 7,000 other higher education institutions across 6 continents (THE, 2019). At an international scale, these declarations recognize this wicked issue. The UBC community highly supports this declaration, with over 5,000 campus community members participating in the climate strike on September 27th, 2019 and over 1,600 who signed an open letter calling on UBC to declare a climate emergency (Ono, 2019). UBC's declaration underlines the importance of embedding climate justice into campus policies which include issues such as the health and wellbeing of people and the earth (Ono, 2019). Food climate justice is an integral part of a climate justice system.

The current Climate Action Plan (CAP) includes food related emissions as scope 3, thus, they are not considered to be under the immediate control of the University (UBC, 2015b). To realize climate justice, our report informs the UBC CAP 2030 to identify food as an important carbon emission reduction category that is within the control and influence of UBC. Our research purpose is to advise the development of policies and guidelines that accelerate UBC's transition towards a climate-friendly campus food system and inform future climate action planning processes. To achieve this transition, we determined two research goals: (1) to promote actions which aid UBC's policies and progression towards a sustainable food system while addressing GHGe reductions, and (2) to define a climate-friendly food system and apply it to the context of UBC's campus food system.

Our research objectives were to: (1) identify how other post-secondary institutions are leading in terms of adopting and implementing climate-friendly food policies and guidelines; (2) assess how UBC and UBC Food Services (UBCFS) are aligned with the goals of the current UBC CAP and the recent UBC Climate Emergency Declaration; (3) develop climate-friendly food procurement guidelines to inform UBC Food Services; and (4) develop climate food targets to inform the UBC CAP 2030.

We utilized three research methods to achieve our research objectives. To address objectives 1, 2, and 4, we conducted a literature review of current leading climate related food system policies and strategies of other institutions to inform UBC's CAP 2030 and UBC Food Procurement Guidelines. To address objectives 2 and 3, we reviewed secondary data, including UBCFS categorical food spend from 2016-2018, the 2018 sustainability reports from major food suppliers, and menu offerings from UBCFS dining halls. To address objectives 2, 3, and 4, we collected primary data from interviews of relevant stakeholders. We interviewed stakeholders involved with campus food procurement and sustainability initiatives, as well as climate planning to inform recommendations that are applicable to the UBC context.

Based on our findings from the primary and secondary data, we provided two sets of immediate actionable recommendations. The first set of 5 recommendation is oriented towards UBCFS: (1) Increase procurement of foods low in GHGe that are local and seasonal, (2) create a new system to track food-related GHGe on campus, (3) implement nudging strategies and improved rewards programs, (4) continue to train chefs on creating delicious plant-based meals, and (5) pilot a 100% plant-based food outlet. The second set of 4 recommendations aims to inform UBC Campus and Community Planning for the CAP 2030: (1) assess the current GHG impact of the UBC campus food system, (2) create and enforce a climate-friendly food system framework, (3) create an online platform to purchase directly from local producers, and (4) advance community education on food system sustainability.

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Liska Richer, Instructor, Faculty of Land and Food Systems

Corine Singfield, Teaching Assistant, Faculty of Land and Food Systems

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List of Abbreviations

AMSFS - Alma Mater Society Food Services

CAP - Climate Action Plan

CF - Climate Friendly

CFFS - Climate Friendly Food System

GHG - Greenhouse Gas

GHGe - Greenhouse Gas Emissions

LFS - Faculty of Land and Food Systems

SEEDS - Social Ecological Economic Development Studies

SHHS - Student Housing and Hospitality Services

UBC - University of British Columbia

UBCFS - University of British Columbia Food Services

1. Introduction

1.1 Research Topic

Food systems have a crucial and complex role to play in sustaining socio-ecological well-being. They are intricately connected to global climate conditions and are vulnerable to change. Agriculture's intensive resource demands are playing a role in destabilizing earth system functions, with major contributions to land-use changes, biogeochemical flows, biosphere integrity and climate change (Campbell et al., 2017). With a growing global population, agricultural greenhouse gas (GHG) emissions will likely continue to increase as food production is projected to rise by 60% by 2050 (Alexandratos & Bruisma, 2012). Transformation of current food system activities is necessary to continue supporting a healthy and flourishing global food system. To reach the global Paris Agreement Climate Change targets of staying within 1.5 °C, it is imperative that the agriculture sector also contribute to emissions reductions (Meadu et al., 2015). The EAT-Lancet Commission report on Healthy Diets from Sustainable Food Systems positions food as the single strongest lever to optimize environmental sustainability and human health (Willett et al., 2019).

The global climate crisis requires urgent action to minimize its potential impacts. Governing bodies and institutions across Canada and the world are working collectively to help mitigate and adapt to climate change. UBC is committed to a just and sustainable food system, inspiring collaborative action to catalyze global change. As a leader in campus sustainability, UBC must take steps to bring food challenges to the forefront and prioritize transformations towards a climate-friendly campus food system (CFFS). UBC Food Services (UBCFS) has made commendable progress in increasing plant-based food offerings in past years. However further effort can be made to establish guidelines for climate-friendly procurement. With the UBC 2030 Climate Action Plan underway, collectively enforced good practices can reinforce the campus' commitment to reducing food system emissions as well as increasing resilience and adaptability. There is a need for improved

understanding of where to focus within the existing UBC food system to reduce GHG emissions (GHGe). UBC has the ability to leverage existing campus efforts and strengthen its contributions to climate action. This research offers opportunities to decrease campus emissions and create a unified vision for a climate-friendly (CF) food system.

1.2 Research Relevance

Climate change has already affected global food security due to warming, changing precipitation patterns, and the greater frequency of extreme climate events (IPCC, 2019). Creating climate-friendly food systems is vital to reducing emissions, while supporting adaptation and food security. The UN's Sustainable Development Goals (SDG) aim to address the world's most pressing issues, working towards a better and more sustainable future. There is a global focus on integrating responsible socio-ecological practices into food system activities to ensure a sustainable and equitable future for all (UNDSDG, nd.). Nationally, A Food Policy for Canada is working towards establishing a food system which is resilient and innovative, sustains the environment and supports the economy (Government of Canada, 2017). Metro Vancouver's Regional Food System Action Plan is also determined to foster a sustainable and adaptive food system through social, environmental and economic efforts to improve community health and well-being (Metro Vancouver, 2016). Climate change and sustainable food systems have been made a priority for policies on all scales, including at UBC where ambitious actions are being taken to address these issues.

Through UBC's CAP 2020, the University has committed to reducing campus GHGe by 67% as of 2021 and aim for a 100% reduction by 2030 (UBC, 2015). These targets align with the need to keep global average surface warming to 1.5°C as laid out by the Paris Agreement and emphasized by the IPCC's Special Report on Global Warming (IPCC, 2018). The CAP's current plans to address food systems issues are limited. Exploring ways to address food emissions reductions and transitioning to low carbon menus is listed as an opportunity in

the document, but robust targets and actions are yet to be identified.

The UBC community, especially campus sustainability initiatives such as UBC Climate Hub, UBC350, Alma Mater Society (AMS), and the UBC Farm, have been advocating for a responsible food system that encourages low-carbon practices and promotes food security (UBC Climate Hub, nd.; UBC350, nd.; AMS of UBC, nd.; UBC Farm, nd.). Campus and Community Planning and UBC Food Services have been working towards re-evaluating common goals and values for climate action and food systems. Through the development of CF recommendations and policies for the UBC campus, our research identifies priority areas of focus for GHG reductions in food procurement. Our recommendations can contribute to advancing current UBC campus planning processes which fail to consider food systems as a priority for climate action. Working with key community stakeholders, we have identified a list of tangible and inclusive solutions, which will help transition UBC towards a low-carbon and resilient campus food system.

1.3 PROJECT CONTEXT

The agri-food system currently contributes majorly to climate change, with an estimated 5 billion metric tonnes of CO2 equivalent added to the atmosphere each year - approximately a quarter of global GHGe (FAO, 2019). In Canada, emissions from agriculture accounted for 8.4% of total GHGe in 2017. This only accounts for the production of food while the transportation, waste management, and land use changes are represented elsewhere in the Canadian inventory (Government of Canada, 2019). It is quite difficult to account for all factors which contribute to emissions related to our food system due to the inherent complexity of the system. It is necessary to shift the current paradigm and develop a more climate-friendly food system; one which is regenerative, resilient, and reduces emissions all while feeding the growing population.

After growing pressures, UBC announced a Climate Emergency Declaration in late 2019. This is in line with

many other communities and institutions across the globe declaring a climate emergency. The University acknowledges the need for drastic emissions reductions and specifically mentions the importance of accelerating timelines for existing actions under the current UBC CAP 2020 (UBC, 2019). They also realize the need to develop climate food targets to inform the UBC 2030 CAP, as the current plan only briefly mentions the food system as a complimentary opportunity to reduce emissions. UBC currently considers food system emissions as scope 3, meaning they are indirect emissions which are outside of the University's immediate control (UBC, 2015). In fact, the previous iteration of the CAP, the CAP 2010, included more of a focus on GHGe related to food and identified action items which would help shift UBC towards a more sustainable, low carbon food system. (UBC, 2008). Nonetheless, the recent Climate Emergency Declaration by UBC and the commitment to the new 2030 CAP display an ambition to re-examine food related emissions and categorize them as emissions which the University has influence and a control over (UBC, 2019). Hence, they need climate food targets to inform the new CAP.

UBC Food Services' current Food Vision and Values expresses their commitment towards contributing to a more sustainable food system, and in recent years they have made many changes towards offering more CF food options. These changes include purchasing over 60% of ingredients from local producers (within 400 km of UBC), as well as reducing the prevalence of meat (particularly red meat) and focusing more on plant-based options (UBC Food Services, 2019). However, UBCFS is in need of more robust evidence- based procurement guidelines to help steer them towards a more CFFS. In particular, they need help in identifying food items within various categories (eg. grains, vegetables, meat, and dairy) which would have the greatest impact on improving the climate-friendliness of the campus food system. These guidelines will consider various factors including the seasonality of various foods,

where the food is grown or produced, and typical production practices.

In order to achieve the above-mentioned objectives, this project must begin by creating a working definition for a CFFS. There is currently a gap in the literature regarding what exactly a climate-friendly food system entails. However, there are some existing policies and best practices that can help in shaping guidelines for a CFFS. To begin with, the report written by the LFS 450 group which addressed this subject in 2019 is a good starting point (Liu et al., 2019). Their report identified some key principles that can help inform the definition of a CFFS. These principles included sustainable production and processing practices, minimal and efficient transportation of food, prioritizing biodiversity, and meeting the needs of the local population (Liu et al., 2019). They also received some important feedback to these preliminary findings from the community at the 2019 Climate-Friendly Food Forum. More specifically, feedback from attendees included that the definition should incorporate cultural diversity, particularly since some cultures and traditions are rooted in the consumption of meat products or products that are unavailable in Canada. Furthermore, this group identified UBC's sustainable purchasing guide, sustainable sourcing strategies of student run food outlets on campus, eco-labels, and a carbon tax on food as potential best practices (Liu et al., 2019).

There are also a handful of global initiatives with many members that are pushing for a more climate-friendly food system. One example is the Cool Food Pledge, which helps dining facilities lower food-related greenhouse gas emissions by 25% by 2030. Current members include Harvard University, IKEA, and the city of Milan. This is a way for organizations and institutions to be held accountable for their climate actions and ensure they are on track to reach goals set out in the Paris Agreement (Cool Food Pledge, 2019). In Europe there is currently an initiative known as FoodSHIFT2030 which launched this year and aims to transition the European food system towards a low carbon, circular future,

including a shift to less meat and more plant-based diets. The initiative takes place in nine cities across Europe with stakeholders from the private, public, voluntary, and academic sector (Food Shift 2030, 2019). Another global commitment is the C40 Good Food Cities Declaration, which includes 14 signatory cities that serve 500 million meals per year. The cities that committed to the declaration plan to align their food procurement policies to the planetary health diet, reduce food loss waste by 50%, and support an increase in healthy plant-based food consumption (C40 Cities, 2019).

It is apparent that the current food system is flawed and unsuited to address the climate crisis. However, there is potential for a shift towards a more CFFS which is focused on minimizing GHGe. If left unchecked, this climate crisis could lead to drastic consequences for our planet and its inhabitants (IPCC, 2018; United Nations, 2015). Thus, it is necessary to take urgent action and begin adopting policies and best practices such as those mentioned in this review. UBC has the opportunity to take urgent action and shift the campus food system to a climate-friendly system. As a leader in sustainable initiatives, UBC can further their influence and commit to some of the policies and best practices that were mentioned above. Although some of these policies might seem a bit broad and non-explicit, it is important to realize that many governments, institutions, and organizations have just begun taking steps towards remedying climate change and shifting towards a more climate-friendly food system. This is just the beginning and there is still much work to be done in the immediate future.

1.4 Project Purpose, Goals and Objectives

Research Purpose

To advise the development of policies and guidelines that accelerate UBC's transition towards a climate-friendly campus food system and inform future climate action planning processes.

Research Goals

1. Promote actions which aid UBC's policies and progression towards a

sustainable food system while addressing GHG emissions reductions.

2. Define a climate-friendly food system and apply it to the context of UBC's campus food system.

Research Objectives

1. Identify how other post-secondary institutions are leading in terms of adopting and implementing climate-friendly food policies and guidelines.
2. Assess how UBC Food Services and UBC is currently aligning with goals in the current UBC CAP, and with the recent UBC Climate Emergency Declaration.
3. Develop climate-friendly food procurement guidelines to inform UBC Food Services.
4. Develop climate food targets to inform the UBC 2030 CAP.

2. Methodology and Methods

2.1 Research Methodology

A priority of this project was to be inclusive of the vision and values of all affected stakeholders. This project utilized principles of Community Based Action Research (CBAR) to discern the predominant attitudes amongst participants in the UBC Food System and to determine the system's sustainability. To achieve this goal the methodology followed the iterative 'Look-Think-Act' process. During the first phase, 'look', data was gathered and examined for apparent patterns and meaningful associations. During the next phase, 'think', the team critically interpreted the data by considering what factors in the food system shape the observed results. Finally, the team 'acted' by identifying critical areas for change within the UBC food system and by providing recommendations for climate and food related policy. This report also aims to support and inform further community based action research regarding climate-friendly food systems at UBC or at other institutions. By adhering to this methodology, we achieved the project goals in a socially conscious and inclusive way.

2.2 Research Methods

2.2.1 Secondary Data Collection Research Methods

We conducted a literature review early in the project to gain a better background understanding of the subject matter. The focus of the literature review was on the following four categories: procurement and menu offering guidelines, institutional definitions of climate-friendly food systems around the world, categories of food groups and their relative greenhouse gas intensities, and climate targets set forth by other University initiatives.

A search for existing uses of the term "climate-friendly food system" helped frame our working definition and application to the UBC campus food system. A review of GHGe production in the food sector led to increased understanding of emissions intensities associated with different food types as well as agricultural production methods, and food locality and seasonality. This research informed guidance on food procurement recommendations for UBCFS. We also researched current climate related food system policies, strategies of other institutions, and relevant guidelines. A consolidated review of relevant literature was completed before diving into our primary data collection and analyzing data received from UBCFS; this allowed us to garner a better understanding of pre-existing research on climate-friendly food systems which guided the development of our interview questions as well as our analysis of sales and procurement data for UBCFS.

The procurement data that was made available and reviewed by our team included; a categorical breakdown of UBCFS food spend from 2016-2018, sustainability reports from 2018 for several of UBC's major food suppliers, and aggregated food outlet purchases for 2017-2020 from the major seafood supplier, Albion.

The categorical breakdown of food spend and the sustainability reports were analyzed as they provided the most comprehensive and encompassing information while adhering to the scope of this project. It is also important to note that we were limited to working with procurement data in dollar amounts as there were

numerous complications with examining data in weight. The sustainability reports were provided by the major suppliers of the food categories: grocery, produce, dairy, meat, seafood, poultry, baked goods, frozen items, and beverages. Each supplier provided a list of the items purchased, which of the food categories it belongs to, the quantity purchased, and the total amount spent on the item. They also indicated if the product achieved certain sustainability indicators such as organic, fair trade, locally sourced, Oceanwise, hormone-antibiotic free, or free range. This data was analyzed and reconfigured using simple statistical analysis tools in excel, and then visually represented to identify trends.

Menu offerings data from UBC Food Services' three dining hall locations were analyzed to determine the number of items containing ruminant products (beef, lamb, dairy). Residence dining halls Feast, Gather, and Open Kitchen were examined to understand what and how menu items are being served. We retrieved recipe information and menu offering data from UBCFS's Nutrislice website. We used similar methods as were used by Fu et al. (2020) to calculate the percentage of plant-based offerings in the resident dining halls. We looked at menu items offered over the course of March 2020 to identify ruminant offerings. By examining the data, we were able to make suggestions for the reduction of ruminant products. The total number of offerings as well as those containing ruminant products were calculated to determine the percentage of offerings containing ruminant products in UBC dining halls.

2.2.2 PRIMARY DATA COLLECTION RESEARCH METHODS

Our primary data was collected using semi-structured interviews of relevant UBC food system stakeholders. A snowball approach was used to recruit interview participants (Appendix A). This approach included reaching out to our client partners at UBCFS and Campus and Community Planning to identify key players involved with campus food procurement and climate planning, then asking them if they knew other potential informants in this same area. We selected research participants who

worked directly with or were knowledgeable about the UBC food system and UBC food procurement, and contacted them over email (Appendix B). Our sample size was n=6 and the interview participation rate was n=6/7 or 85.7%. Interviews were done in person for n=5 participants, and over Zoom video-conference call for n=1 participant (Table 1).

2.3 Methods of Administration

Potential participants were emailed directly and asked to participate in our study (Appendix B). Interviewees were asked seven predetermined questions (Appendix C). Our rationale for conducting face-to-face interviews was to engage in dialogue with our participants to go beyond the questions outlined. We aimed to have natural style conversations where we could ask for clarifications or have our participants elaborate on their responses. Interviews conducted with UBC food system professionals (Table 1) took between 30 and 40 minutes to complete.

Table 1. List of interview participants as well as dates and locations of the interviews.

Participant	Participant Role	Date and Time	Location
David Speight	UBC Food Services Executive Chef & Culinary Director	March 3, 2020 11:00am	MacMillan Room 360
Melissa Baker	Manager, Nutrition & Wellbeing for UBC Student Housing and Community Services	March 5, 2020 9:30am	Student Housing Main Office
Jeremy Scott	UBC Food Services Executive Chef; Catering, Restaurants & Retail Operations	March 6, 2020 12:00pm	Feast at Totem Dining Hall
Chloe Repka	Climate Planning Coordinator	March 6, 2020 2:30pm	MacMillan Room 350
Dani Stancer	Associate Vice-President Sustainability for the AMS Student Society of UBC	March 13, 2020 3:00pm	MacMillan Room 170-170A
Jessica Schellenberg	Meal Exchange Good Food Campus Lead-Western Canada	March 20, 2020 10:30am	Online via Zoom

3. Results

3.1 Secondary Data – Literature Review

3.1.1 Defining a Climate-Friendly Food System

Climate-friendly food is a relatively new term which lacks a concise definition. It is used by various organizations, institutions, and is mentioned in the literature, but there is a lack of consensus on what the term truly means (Drew et al., 2020; Edwards et al., 2009; Hamerschlag et al., 2017; Liu et al., 2019). After completing the literature review, we identified some key guiding principles (Figure 1) that define a CFFS.

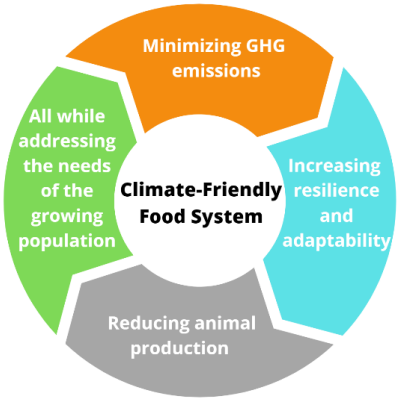

Figure 1. The four main guiding principles for a climate-friendly food system (Adapted from Drew et al., 2020; Edwards et al., 2009; Hamerschlag et al., 2017; Liu et al., 2019).

This is by no means an extensive figure, but it offers some insight into how to frame a definition for a CFFS. Other important principles of a CFFS include minimal environmental impacts beyond just GHGe, such as minimal pollution, energy use, waste, and impacts on biodiversity (Edwards et al., 2009; Liu et al., 2019).

3.1.2 Choosing Food for a Climate-Friendly Diet

GHGe by Food Type

A meta-analysis conducted by Poore & Nemecek (2018) summarized GHGe by food type and found that 53% of global emissions from the agriculture sector originate from livestock and fisheries (Appendix D). The average energy conversion rate from producing animal protein is much higher than from plant-based protein (Garnett et al., 2016). Producing 100 g of plant-protein from peas emits 0.4 kg CO2e, while the same amount from beef protein emits 35 kg CO2e, equating to nearly 90 times more emissions (Ritchie & Roser, 2020). In addition, the increased land requirements for animal feed and grazing contributes to a significant portion of their GHGe (Poore & Nemecek, 2018). The type of meat we consume directly translates to different GHGe (Appendix E). Ruminants (e.g. cows, sheep, goat) produce the most emissions as they undergo a digestion process called enteric fermentation, which produces large amounts of methane gas (Garnett et al., 2016). It is estimated that ruminant meat emits an average of approximately 150% more GHGs than chicken or fish (Weber & Matthews, 2008). Furthermore, dairy products (e.g. milk, cheese, yogurt) from ruminant animals can often contribute a greater amount of emissions than poultry and seafood due to their associated methane emissions (Poore & Nemecek, 2018).

Most plant-based products produce 10-50% less GHGe than animal-based proteins (Poore & Nemecek, 2018). A large portion of plant-based proteins such as soybeans, peas, and lentils are leguminous plants. Legumes help fix nitrogen in soils which can help fuel CO2 sequestration under certain management practices (Thomas et al., 2006). A preliminary scan comparing global emissions from grain products such as wheat, oat, barley and rye revealed inconsistent trends in crop emission intensities (Camargo et al., 2013; Rajaniemi, 2011; Vetter et al., 2017; Zhang et al., 2017). Rice production is often associated with a higher GHG output due to paddy flooding techniques which produce methane gas (Maraseni et al., 2009). That said, average emissions from rice are comparable to plant-based proteins such as tofu (Poore & Nemecak, 2018). Plant-based products often have lower land-use and on-farm emission requirements regardless of their production methods (Ritchie & Roser, 2020). Emissions produced by different plant crops are highly dependent on their production systems and environmental qualities (Edwards-Jones, 2010; Clark & Tilman, 2017).

Comparing Emissions by Diet

A review examining trends in GHGe and other environmental indicators found that ruminant meat (beef, goat and lamb) had an impact 20–100 times greater than plant products, and that whole milk, eggs, pork, poultry, and seafood had an impact 2–25 times higher than plants per kilocalorie of food produced (Clark & Tilman, 2017). A Swedish study conducted by Bryngelsson et al. (2016) compared six different diet scenarios and their associated GHGe. They found that eating plant-based diets such as vegan and vegetarian as well as what they described as a "climate carnivore" diet produced the lowest amount of emissions. The climate carnivore scenario excluded all ruminant products such as beef and dairy by shifting to poultry, fish, and alternative milks (Bryngelsson et al., 2016). Scarborough et al. (2013) examined a similar set of diet scenarios and found that the average GHGe in kilograms of carbon dioxide equivalents per day (kgCO2e/day) ranged from

7.19kgCO2e/day for high meat eaters consuming more than 100g/day, to 3.91kgCO2e/day for fish-eaters, to 2.89kgCO2e/day for vegans.

GHGe by Agricultural Production Method

Agricultural certifications can help consumers gain a better understanding of how their food has been grown. Recognized organic labelling such as USDA Organic prohibits the use of synthetic inputs and ensures that production factors such as soil and water quality are maintained (USDA, 2019). Knudsen (2011) compared GHGe per kg of organic and conventional products and found no general difference in GHG performance of the products. However, when examining only plant-based products, organic products produced marginally lower emissions (Knudsen, 2011). Even in studies where organic production methods produce less GHG per production area, the lower average yields per area requires more land space, potentially reducing the net benefit (Mondelaers et al., 2009; Clark & Tilman, 2017).

When examining production methods more broadly than just certified organic, some studies identified practices that are less GHG intensive (Clark & Tilman, 2017; Edwards-Jones, 2010). In a review comparing grass-fed and grain-fed beef, results showed that due to larger land-use requirements and less efficient feed digestion, grass-fed beef produced on average 19% higher GHGs per unit of food (Clark & Tilman, 2017). Determining best practices for agricultural products is a complex task. The variability of systems makes it difficult to quantify differences. For example, in crop production, the capacity of soils to emit or sequester GHGs changes significantly based on the soil's physical and chemical structure (Koerber et al., 2009).

GHGe from Local and Seasonal Foods

Eating local food has often been promoted as a means to lower the GHG emissions associated with food choices (Friel, 2009; Stehfest, 2009). There is little consensus about the definition of local food, as an individual's understanding of locality can range from the size of a state/province to a

50 km radius around an individual's residence (Edwards-Jones, 2010). Eating locally can have an impact on GHGe of transportation accounts for a large share of the product's emissions. However, transportation emissions on average only account for about 6% of food's carbon footprint (Ritchie & Roser, 2020). That said, imported food that is transported by air can have a significantly larger impact than food that has travelled by boat or truck (Poore & Nemecek, 2018). Transporting food by air emits around 50 times more GHG than transporting the same amount by sea (Ritchie & Roser, 2020).

Macdiarmid (2014) distinguishes between globally seasonal (produced locally in-season but consumed anywhere in the world) and locally seasonal products (produced locally in season and consumed in the same climatic zone). Local produce grown out of season in greenhouse conditions may produce more emissions than produce that is imported but globally in-season (Macdiarmid, 2014; Clark & Tilman, 2017). Buying local products past their seasonal harvest period increases the need for refrigerated storage facilities, which often consume energy and emit GHGs (Canals et al., 2007). Edwards-Jones (2010) compared emissions from lettuce grown locally in the UK and lettuce grown in Spain. They found that despite the longer transport distance, lettuce imported from Spain to the UK in the winter produced less emissions than its local counterpart due to local requirements for fossil-fuel-based heating and lighting. Similarly, tomatoes produced in greenhouses in Sweden used 10 times as much energy as imported tomatoes from Southern Europe where they were in season (Carlsson-Kanyama, 2003).

3.1.3 Barriers to a Climate-Friendly Diet

Many studies have concluded that eating a climate-friendly diet has positive effects on both human health and the environment (Clark & Tilman, 2017; Scarborough et al., 2013; Willett et al., 2019). However, there are still many barriers for global food systems and consumers to shift to a CF diet. The largest barrier to climate-friendliness is that food systems are often excluded from institutional CAPs, despite

their significant impact on the environment (Lea et al., 2006). If they are mentioned, their importance is downplayed and often the recommendations are too vague for action. The second barrier is that there is a lack of a replicable system and methodology to reliably track the GHGe from food systems (Lea et al., 2006). Without a replicable system and methodology to reliably track GHGe, it becomes difficult to classify and measure the GHGe from food systems. Having a reliable system is crucial, as it is needed to create a GHGe baseline, to identify priority areas, and to set concrete targets for reduction. The third barrier is the long-held social and cultural beliefs associated with eating meat. In Western cultures, eating meat has been established as a social norm, and is often considered to be an integral part of a meal (Pohjolainen et al., 2015; Sabaté & Soret, 2014). These beliefs play a role in creating certain negative perceptions around being vegan or vegetarian, such as being weak or feminine (Pohjolainen et al., 2015). Next, there are often misunderstandings or a lack of information on plant-based diets. A common misunderstanding is that they are bland, boring, or nutritionally inadequate (Pohjolainen et al., 2015). Misunderstandings like these usually stem from a lack of information on the nutrition of plant-based diets, as well as how to prepare and cook them in a tasty way. Finally, the biggest barrier for consumers is a general unwillingness to change their dietary habits (Lea et al., 2006). The positive qualities attributed to meat are that it is tasty, versatile, and easy to buy and prepare, making it hard for many to give up (Pohjolainen et al., 2015). However, it has been found that those who are younger and university-educated tend to be more receptive to eating plant-based, making them a key group to target (Lea et al., 2006). Therefore, it is beneficial to examine good practices academic institutions have implemented to combat the aforementioned challenges.

3.1.4 Institutional Good Practices and Policies for a Climate-Friendly Food System

University meal plans and dining halls are responsible for feeding thousands of

students every day. Accordingly, an effective way to encourage people to eat more plant-based foods would be to investigate the different approaches academic institutions have taken to tackle this issue (Table 2) and see if these practices are applicable to UBC. Some approaches that have been implemented include a first-year university course on food sustainability (Jay et al., 2019), the Kale Yeah rewards program (Friends of the Earth, 2018), banning high-carbon meats (University of Cambridge, 2019), taste-focused relabeling of plant-based food (Stanford University, 2017; Stanford University, 2019), and aiming to create a circular foods system (Small, 2012). By implementing these strategies on an institutional level, there is a hope that sustainable attitudes and behaviors towards food will also be carried into society and have a ripple effect.

Table 2. The results of good practices and policies that have been implemented by institutions for a CF food system (Adapted from Jay et al., 2019; Friends of the Earth, 2018; University of Cambridge, 2019; Stanford University, 2017; Stanford University, 2019; Small, 2012).

Institution	Good Practice/Policy	Result
University of California Los Angeles	Implemented a first-year course called Food: A Lens for Environment and Sustainability	Students who completed this course decreased their consumption of ruminant meat products by 28%.
University of Portsmouth	Partnered with Friends of the Earth to create the electronic Kale Yeah! rewards program, which rewards students with a free meal after buying 6 vegetarian or vegan meals	The rewards program incentivized students to try different plant-based meals and the electronic convenience of the program made it easy for students to track their progress.
University of Cambridge	Complete removal of beef and lamb from campus menus	The University has successfully reduced 10.5% of carbon emissions in 3 years.
Stanford University	Positive relabeling plant-based foods in a way that emphasizes their taste	Students significantly increased their consumption of vegetables while they decreased their purchases of junk food and meat products.
University of Massachusetts Amherst	Aiming to create a carbon-neutral system by purchasing 100% of their food locally and eliminating all food-related wastes	As of 2012, the University purchases 30% of their food locally and has implemented 100% biodegradable, compostable flatware, bowls, and utensils at all retail locations.

3.1.5 Global Initiatives and Guidelines

To achieve the global temperature targets set by the Paris Agreement (United Nations, 2015) as well as healthy, nutritious,

and appropriate food for all, it is vital that the good practices in Table 2 be made accessible to other cities, organizations, and food-related groups around the world. The Paris Agreement recognizes that in order to effectively address climate change, a global collective effort is needed (United Nations, 2015). Some examples of the initiatives and guidelines (Table 3) supporting this collective action are: the Cool Food Pledge, which supports its' members in shifting to plant-based menus (Cool Food Pledge, 2019); Meat of the Matter, a guideline for implementing CF food policy (Hamerschlag et al., 2017); and C40 Good Food Cities Declaration and FOODSHIFT 2030 which aim to support cities in transitioning to CFFS through policy and community-based approaches (C40 Cities, 2019, FoodShift2030, 2019). Similar initiatives are being taken to connect universities. Meal Exchange promotes the purchasing of local, sustainable, and ethical food (Meal Exchange, n.d.). Menus of Change - University Research Collaborative allows campuses to be living laboratories for food systems research and provides a platform to share their findings (The Culinary Institute of America, 2020).

Table 3. Goals and strategies of climate-friendly initiatives and guidelines that have been implemented by institutions around the world. (Adapted from Cool Food Pledge, 2019., C40 Cities, 2019., Food Shift 2030, 2019., Hamerschlag et al., 2017., Meal Exchange, n.d.)

Initiative/ Guideline	Goal	Strategy
Cool Food Pledge	Members pledge to decrease food-related greenhouse gas emissions by 25% while addressing the interests of consumers and lowering overall climate footprint.	Assists members in creating climate-friendly food plans by implementing nudging strategies and shifting towards less GHG intensive menus.
C40 Good Food Cities Declaration	Member cities achieve a planetary health diet for all citizens by 2030 while provisioning nutritious and culturally appropriate foods.	Mayors will work with several stakeholders in their cities to reduce food loss waste by 50%, support an increase in healthy plant-based food, and shift procurement policies.
FOODSHIFT 2030	Aims to transition the European food system towards a low carbon circular future, including a shift to less meat and more plant-based diets.	A "bottom-up" approach by supporting and testing new technologies in local communities via Accelerator Labs that also facilitate knowledge transfer across the E.U.
Friends of the Earth- Meat of the matter	To aid U.S. cities and counties in the transition towards climate-friendly and health-conscious food systems.	Provides model implementation plans, policy targets, and other tools for the successful integration of plant-based, local, and organic foods.
Menus of Change: University Research Collaborative	Aims to integrate ideas from academic, business, culinary, and consumer perspectives in order to shift the food system towards healthy, sustainable, and delicious food.	Members research food issues in university settings and share evidence-based findings with partners in the culinary and food systems industry.
Meal Exchange: Good Food Challenge	To engage and connect post-secondary students across the country in projects that work to make positive change in university food systems.	Students campaign for their schools to commit to the Good Food Challenge and increase purchasing of local, organic, and ethically sound foods by 20% before 2025.

3.2 Secondary Data – UBC Food Services Procurement and Menu Data

3.2.1 Procurement Data - Food Category Spend

We were able to analyse procurement data from UBC Food Services to see spending on various food categories in 2016, 2017, and 2018. These food categories included produce, grocery, dairy, poultry, meats, beverages, frozen items, baked goods, and seafood (see Appendix F for definitions of each category). The spend per year for each category and the shifts throughout the years can be seen in Figure 2. The amount spent on seafood and meats has only seen minor shifts, but the amount spent on dairy and grocery has increased significantly over the years. The amount spent on produce saw a large increase from 2016-2017 but a small decrease from 2017-2018 (Figure 2). Additionally, overall food spend was increased by 25% from 2016-2017 and approximately 4% from 2017-2018. Percentage changes between the years for funds spent on each individual category can be found in Appendix G. It is important to note that there were some inconsistencies found in the data and numerous assumptions had to be made in order to compile and analyse all the data. These inconsistencies and assumptions will be discussed further in section 4.4.

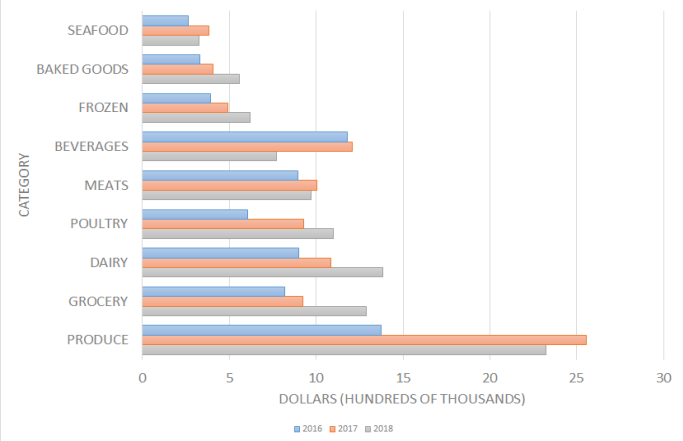

Figure 2. A bar graph depicting the total amount that UBC Food Services spent on various food categories per year, from 2016-2018. Note that the scale is in hundreds of thousands of dollars (Canadian Dollars).

We also looked at the proportion of total funds spent on each food category for each of the three years, as seen in Figure 3. Produce has seen significant shifts through the years but has remained the largest contributor to the overall food budget (20-28%), followed by grocery, dairy, poultry, and meats (Figure 3).

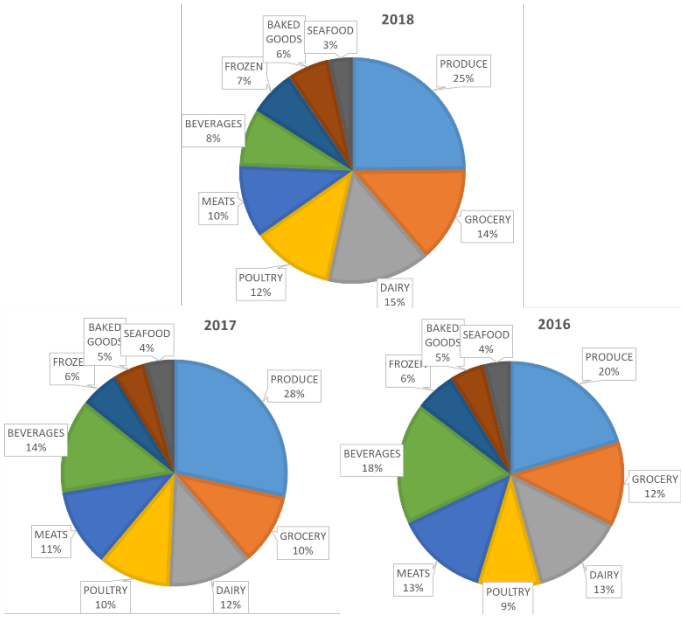

Figure 3. Pie charts which depict the proportion of total funds spent by UBC Food Services on various food categories for 2016, 2017, and 2018.

3.2.2 Procurement Data - Sustainability Reports

We also analysed sustainability reports that were submitted to UBCFS by several of their major food suppliers. The most reliable and relevant indicator across these reports was whether the products were locally processed or locally grown. Here, local is defined as a radius of 400 km around the campus, ignoring political borders (UBC Food Services, 2019). This data was synthesized and reconfigured (Appendix H) to determine the proportion of money spent on locally sourced items for each food category (Figure 4).

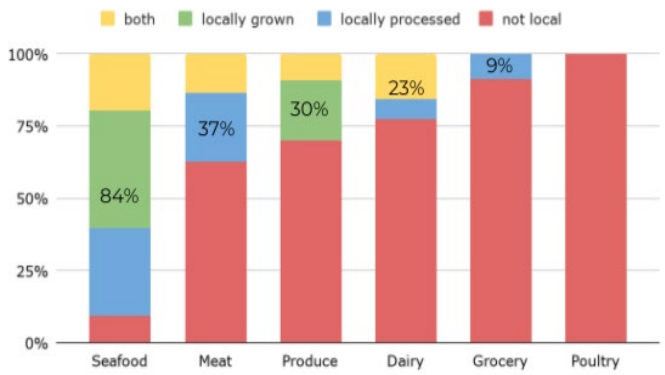

Figure 4. Bar graph depicting the percent of UBC Food Services' food spend in 2018 on locally sourced items broken down by food category.

The category with the highest proportion spent on locally sourced items was seafood, where 84% of the total expenditure was on items that were either locally grown, locally processed, or both. Seafood performed significantly better in this indicator than the other categories. However, because there was data missing in certain reports, there is a high level of uncertainty for several high impact categories like dairy and poultry (Figure 5).

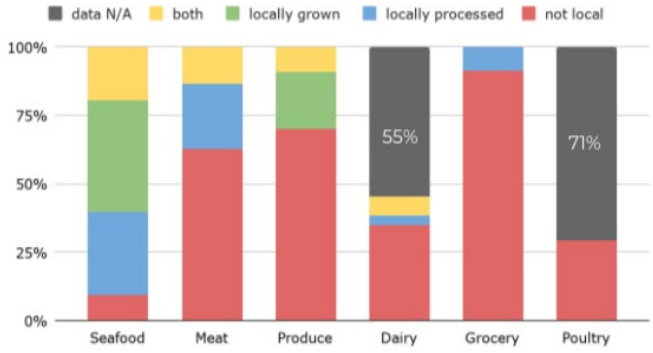

Figure 5. Bar graph depicting the percent of UBC Food Services' food spend in 2018 on locally sourced items broken down by food category, including missing data from the largest suppliers of dairy and poultry.

The two largest suppliers of dairy and poultry had incomplete sustainability reports which resulted in 55% of the total dairy spend to be unaccounted for in terms of the local sustainability indicator and 71% of the poultry spend.

3.2.3 UBC Dining Hall Menu Data

To assess UBCFS alignment with their visions and values, the UBC Food Vision & Values Phase 3 project group conducted an audit of plant-based dining hall menu offerings (Fu et al., 2020). The group examined listings on Nutrislice, an online resource which provides dietary data for menu items offered at each of the three campus resident dining halls; Feast, Gather and Open Kitchen. Over a period of five weeks in Jan-Feb 2020, they found that 46.06% (Table 4) of menu items were plant-based (Fu et al., 2020). Their definition of plant-based menu items corresponded with a vegetarian diet, including dairy and eggs.

Table 4. Plant-based Offerings at UBC Dining Halls (Adapted from Fu et al., 2020).

Dining Hall	Plant-based Offerings	Total Offerings	Percentage Plant-based
Gather	621	1288	48.21%
Feast	480	1164	41.24%
Open Kitchen	512	1050	48.76%
Total	1613	3502	46.06%

To determine the number of offerings containing ruminant products (beef, lamb or dairy), offerings were examined using a similar approach. It was found that 63.33% (Table 5) of dining hall menu offerings contained ruminant products. Due to interruptions in service during COVID-19, data availability was limited on the Nutrislice website. Menu offerings were only assessed over the period of 3 weeks in March 2020.

Table 5. UBC Dining Hall Offerings Containing Ruminant Products.

Dining Hall	Ruminant Offerings	Total Offerings	Percentage Ruminant
Gather	545	947	57.56%
Feast	580	878	66.06%
Open Kitchen	499	752	66.36%
Total	1624	2577	63.33%

3.3 Primary Data – Interviews

Interview responses were transferred into an excel document and iterative coding was used to determine themes based on terms used in responses for questions 1 to 3.

This was done to inform our research goals by bringing to light attitudes and interpretations of professionals working with UBCFS on shifting towards a CFFS. There were 14 themes that emerged from coding of these questions based on the language used by respondents.

Figure 6 shows that when asked "What a sustainable/climate-friendly food system means to you?", seven themes were identified by interviewees. The most responses (31%) discussed GHGe, which were informed by responses using language like decreasing foods high in GHGe and reducing beef and lamb. Next, the theme sustainability followed in prevalence (23%) by responses like regenerative (D. Stancer, personal communication, March 13, 2020), and reducing the impact on the environment (M. Baker, personal communication, March 5, 2020). Local and seasonal were also discussed by respondents (19%), including describing a need to know where food comes from (D. Speight, personal communication, March 6, 2020). Meal Exchange places an importance on Good Food that is community-based, which encompasses location, transparency and size (J. Schellenberg, personal communication, March 20, 2020). Certifications (8%) captured the use of third-party certifications to assess Good Food on campus including factors such as community-based, ecologically-sound, socially just and humane (J. Schellenberg, personal communication, March 20, 2020), with organic and fair-trade given as examples. Melissa Baker used the terms tasty and culturally acceptable to inform the taste category (8%) (personal communication, March 5, 2020).

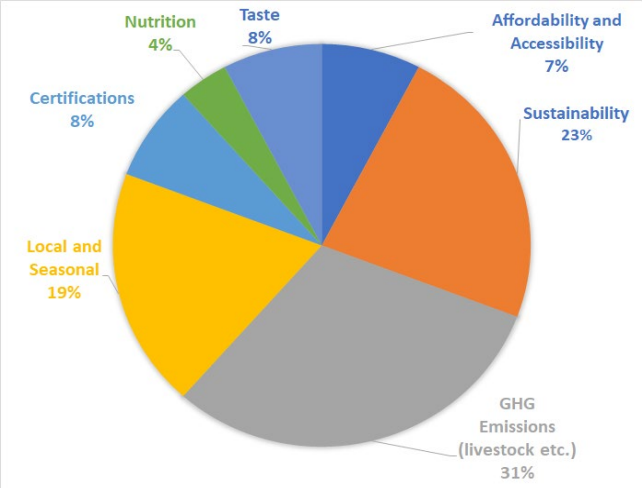

Figure 6. Emergent themes from interview responses to the question, "What does a sustainable/climate-friendly food system mean to you?"

The second question we analyzed was "Based on our draft definition of climate-

friendly food with key principles, how does this fit into your work or role in UBC's food system?". Figure 7 shows 11 emergent themes from interview responses. The theme GHGe similarly made up the largest proportion of responses (22%). Four themes were tied for second most emergent (11%): sustainability, advertising, purchasing strategies, and tracking GHGs. Sustainability was elaborated as ethical/sustainable practices through an environmental, social, and economic lens. Advertising was discussed to share what has been done already. Responses like updating purchasing strategies were used to inform the purchasing strategies category. Tracking GHGs was discussed as coming up with a mechanism to track and reduce GHGs. Affordability and accessibility (8%) were informed by phrases including food insecurity. Profits and chefs came up in responses 7% of the time. One respondent explained the need to have good business practices while making a profit (J. Scott, personal communication, March 6, 2020). Chefs at UBC were said to be trained with more awareness of plant-based foods (M. Baker, personal communication, March 5, 2020).

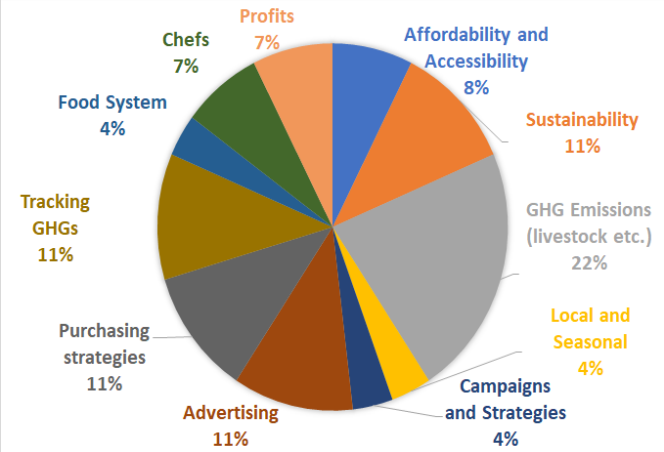

Figure 7. Emergent themes from interview responses to the question, "Based on our draft definition of climate-friendly food with key principles, how does this fit into your work or role in UBC's food system?"

The third question we analyzed was "Where do you see room for improvement in terms of creating a more sustainable food system at UBC?" As seen in Figure 8, affordability and accessibility (25%) rose in prevalence as a theme discussed by respondents. GHGe was still a major area of focus in responses (20%). Local and seasonal, and educating consumers both had 15% of responses. Scott mentioned that the UBCFS are trying to buy from more local businesses (personal communication, March 6, 2020). Speight identified a need to educate students and create an advisory committee

in student residences (personal communication, March 3, 2020). Tracking GHGs (5%) was referenced once by Speight with the idea of rating food items (personal communication, March 3, 2020). Finally, advertising was highlighted as an opportunity by Scott (personal communication, March 6, 2020).

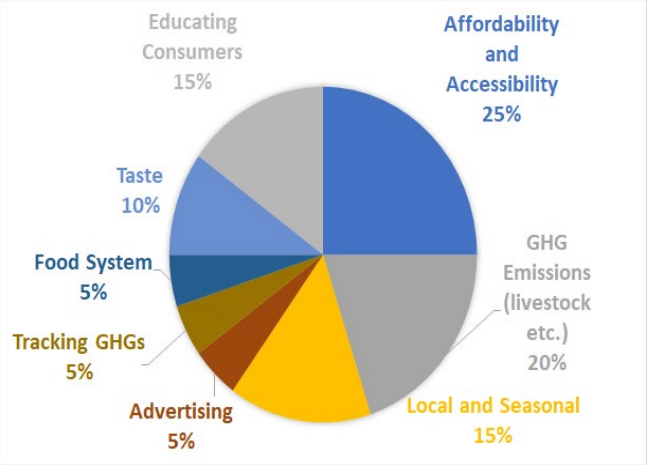

Figure 8. Emergent themes from interview responses to the question "Where do you see room for improvement in terms of creating a more sustainable food system at UBC?"

In the fourth question, "Do UBC staff and students take into consideration the ethics of the food they buy", three respondents claimed that consumers at UBC are not aware. Two respondents said that more students are going plant-based for ethical reasons. Stancer highlighted the importance of what a student studies and where a student comes from on the ethical decisions of what foods they may eat (personal communication, March 13, 2020). Moreover, Speight said that consumers still demand unhealthy options such as chicken strips and hot dogs (personal communication, March 3, 2020).

The fifth question asking respondents for suggestions on programs or incentives to encourage UBC staff and students to make CF food choices found an array of responses. Five respondents highlighted the need to educate consumers and develop educational campaigns regarding CFFS. Promotional campaigns were recommended, for example buying 10 plant-based meals and getting one free (J. Scott, personal communication, March 6, 2020). Further, it was discussed that UBC has had successful campaigns such as Shorter Showers and Cool Campus, and there is a need for a food related campaign (C. Repka, personal communication, March 7, 2020).

In the sixth and final question, we asked our respondents to identify the greatest successes and challenges in terms

of sustainability of the UBCFS. Successes included transitioning to more plant-based offerings (M. Baker, personal communication, March 5, 2020). Repka discussed the decreased beef procurement from 2018-2019 and the blended burger (75% beef, 25% mushroom) as successes in lowering beef procurement (personal communication, March 6, 2020). Three respondents discuss certifications such as fair trade, ethical coffee, and Ocean Wise as successes of the UBCFS. Moreover, UBC's willingness to be evaluated by Meal Exchange and self-reporting to AASHE STARS was reported as a strength according to Schellenberg (personal communication, March 20, 2020). Baker mentioned UBC's Forward Food Conference as a success, an event hosted by UBC where health authorities and universities train chefs (personal communication, March 5, 2020). Two respondents highlighted the challenge of training and educating chefs on plant-based foods. Engaging with students was another challenge, one respondent mentioned the lack of food literacy amongst the UBC community and the need for a common definition of a sustainable food system tailored to UBCFS (J. Schellenberg, March 20, 2020). Further, Stancer highlighted the challenge of working with a student budget (personal communication, March 13, 2020).

4. Discussion

4.1 Defining Climate-Friendly Food

It is important to clearly define a CFFS in order to effectively describe the term and its principles. This ensures a mutual understanding, less potential for misinterpretations, and that no party can alter the term for self-benefit. However, the notion of a CFFS is new and therefore there is no concrete, universal definition of the term (Drew et al., 2020; Edwards et al., 2009; Hamerschlag et al., 2017; Liu et al., 2019). We generated a definition as seen in section 3.1.1, based on research conducted during our literature review. We also received feedback to rework our definition from our clients and from interviews with relevant stakeholders. We isolated four principles that define a CFFS (Figure 1). The first is the

reduction of GHGe, as that is one of the major factors currently driving climate change (IPCC, 2018). Another principle is reducing animal production; as indicated previously, it is by far the main driver of climate change within the current food system (Poore & Nemecek, 2018). Additionally, a CFFS must be able to provide for the needs of the growing population, focusing on health and cultural practices that may be rooted in the consumption of animal products (Willett et al., 2019, Liu et al., 2019). CFFS should also incorporate sustainable production and processing practices, minimal and efficient transportation of food, as well as healthy low impact diets to create a food system that is resilient and adaptable to change. These four CF principles have the potential to foster healthier, more sustainable, and resilient food systems (Edwards et al., 2009; Liu et al., 2019).

Our interview responses were instrumental to understanding how professionals working with the UBC Food Services define a CFFS. They also provided insight into what areas within climate-friendliness are being worked on and which ones need increased focus. This data directly supports our second research goal. In Figure 6, we found that there is a general consensus that a CFFS has low GHG emissions due to less animal-based offerings. Many respondents also agreed that a CFFS must be nutritional, culturally appropriate, and consist of local and seasonal food. Interviewees placed great emphasis on the idea of local procurement, however, our literature review suggests this actually plays a minor role in mitigating food-related emissions.

Our analysis in Figure 7 shows the breadth of work being done at UBC so far to address the key principles of a CFFS that we identified (Figure 1). Every interviewee discussed the importance of GHGe reductions and reductions of ruminant products in diets. There was also a clear awareness of the need to develop a mechanism to track GHGs. Culturally and nutritionally appropriate foods were also valued, particularly by the campus nutritionist. This highlights that across campus

there are multidisciplinary efforts that are supporting UBCFS' quest for a CFFS. By working with a diverse range of actors, UBCFS also increases its capacity to adapt to future change.

4.2 Procurement of Climate-Friendly Foods

As the campus' largest food provider, UBCFS can contribute to large reductions in campus GHGe by encouraging procurement of CF foods. Procurement should focus on selecting foods with the lowest associated emissions impact. Focusing on the type of food that is being purchased and replacing animal products with plant products is the most effective way to reduce emissions from the food system (FAO, 2011; Weber & Matthews, 2008; Poore & Nemecek, 2018; Macdiarmid, 2014). Sustainable production methods may reduce agricultural emissions, however complex and changing external factors such as climate conditions, soil quality, and carbon sequestration capacity can limit the usefulness of comparing production methods as a measure of GHGe (Mondelaers et al., 2009; Clark & Tilman, 2017; Koerber et al., 2009). Transportation only makes up around 6% of global food sector emissions (Poore & Nemecek, 2018), and agricultural methods from different production regions are difficult to hold constant. Therefore, the procurement of local and seasonal food generally has a smaller impact on emissions. That said, UBCFS should avoid purchasing fresh food products that have been shipped by air transportation (Ritchie & Roser, 2020). Additionally, locally and globally seasonal foods may offer a potential to reduce emissions due to decreased storage costs (Canals et al., 2007). It is important to consider the GHG impact of procurement strategies while building a CFFS, and recognize that some strategies are more impactful than others.

4.2.1 Low GHG Intensity Foods

Plant-based proteins have a significantly lower GHG impact compared to animal-based proteins (Appendix E) and should therefore be prioritized in menu creation, with an emphasis on avoiding ruminant products. UBCFS has taken significant steps in recent years to increase

the nutritional quality and sustainability of its food offerings, including a significant shift to more plant-based meals. It set a target of having 50% plant-based menu offerings in its campus dining halls by the year 2020, and is currently very close to this target with 46% plant-based offerings (Fu et al., 2020). Since vegan diets produce the least amount of emissions (Bryngelsson et al., 2016; Scarborough et al., 2014), this plant-based transition aligns with UBC's trajectory towards a CFFS. Ruminant products such as beef, lamb, and dairy are currently offered in approximately 63% of dining hall menu items (Table 5). We also found that the majority of plant-based menu options were vegetarian with dairy products. Vegetarian diets that include dairy can have an even larger associated GHGe than diets which consume low impact meats such as poultry and fish (Clark & Tilman, 2017). Therefore, reducing the availability of ruminant products, including dairy, in all menu offerings would be one of the most effective measures to decrease food system emissions. UBCFS should set a target to halve ruminant menu offerings to about 30% by 2030 in order to achieve this goal. UBCFS has already had success in reducing beef quantities through their blended burger, which replaces 25% of the beef in the patty with mushroom and pea fiber (B. Vigue, personal communication, March 19, 2020). An additional strategy to reduce ruminant products is to eliminate beef options in dishes where it can be replaced by a protein alternative. For example, the steak burrito option at Feast's Bueno Kitchen station could be removed, and the beef protein add-on option eliminated from Open Kitchen's Custom Kitchen. Dairy products such as cheese could also be listed and charged as an add-on for items such as burgers and bowls to defer customers from the products. Further, dairy milk alternatives like oat, soy, almond and cashew milk can be used as substitutes in certain recipes where appropriate.

Although changing menu offerings and procurement strategies can have a significant impact on a food system's climate footprint, there also must be an acceptance

on the part of consumers. Several of our interviewees indicated that simply shifting menus is not very impactful if consumers are not making CF food choices. These choices can be encouraged using nudging strategies, educational campaigns, and rewards programs. Several other universities have implemented these techniques in dining halls while studying and reporting the effects (Table 2). When these studies accounted for the context of the food outlet and the demographics of the consumers, the strategies have yielded positive results. At Stanford University, nudging techniques significantly reduced the purchasing of meat products and junk food relative to the control dining halls that did not use these techniques (Jay et al., 2019). This included re-labelling - plant-based meals with positive adjectives relating to taste or nutrition and displaying posters that featured a CF meal and told a story about the chef that created it. At the University of California - Los Angeles a first-year course called Food: A lens for Environment and Sustainability was offered for credit. It was found that students who completed this course decreased consumption of ruminant animal products by 28% (Jay et al., 2019). Although there are several courses that address food and climate at UBC, many of them are in the Faculty of Land and Food Systems and may be less accessible to other students. Designing a course that is advertised and offered for credit to students from all faculties could aid in decreasing food-related emissions by shifting the prevailing dietary preferences of students. At the University of Portsmouth, a successful plant-based food incentives program was implemented, and it led to increased purchasing of plant-based foods (Friends of the Earth, 2018). Although UBC does have an incentive program, it would be more effective in reducing the climate impact by excluding products that contain dairy and increasing popularity among students.

4.2.2 Local and Seasonal Foods

In choosing foods for a CFFS, the majority of the research was focused on the procurement of low-carbon foods. Although reducing emissions has been the priority,

considering other food system values and principles is important to ensuring a system which is sustainable and resilient to change. Even though the emissions associated with procuring local foods may not be lower than purchasing a similar product from another region of the world, local food can support food system sustainability in other ways. For example, local food is often characterized by certain production values or marketing practices such as community building, food chain transparency, and cooperative programs which offer fair prices to farmers (University of Iowa, 2015). Local food can also help increase resilience in local food supply systems. Our research was conducted during the onset of COVID-19. The viral pandemic disturbed many communication and transportation networks across the globe. With border restrictions and shortages of supply, local food networks are crucial to supporting communities by ensuring sufficient resources. Low-carbon foods may also conflict with other food system values such as animal ethics. For example, grass-fed beef is often considered to be more ethical due to increased space requirements for cattle and provided access to grazing areas (Stuart, 2018). However, due to increased land requirement and less efficient feed digestion, grass-fed beef has a significantly higher GHG intensity. Clark & Tilman (2017) found in their analysis that grass-fed beef produces on average 19% more GHG emissions than grain-fed beef. These points reveal that it is important to consider multiple factors and how these values interact within the food system. Fostering a CFFS requires the integration of social, economic, and ecological sustainability to increase system resilience.

Transparency between UBCFS and their food suppliers is crucial for information to be provided on the origin and production methods of each product. A challenge mentioned by Speight is the lack of a local centralized distribution hub, which indicates a challenge to tracking where the UBCFS food is derived (personal communication, March 6, 2020). As observed from the 2018 sustainability reports, there are often gaps in data provided by the suppliers, making it

difficult for UBCFS to ensure the sustainability and environmental standards of the products that they procure. If this data was available, it could be concluded with greater certainty whether the overall purchasing practices of UBC Food Services contribute to the goal of a CFFS. Nevertheless, it is clear that UBCFS is committed to purchasing local foods; in 2018 the vast majority of seafood purchased was locally sourced, and a portion of produce is purchased from the UBC Farm. There is still room for improvement in high emissions food categories like meat, dairy, and poultry (Figure 5). Other universities are also placing great value on local procurement in the quest for sustainable campuses since it is one of the easier indicators to quantify and assess. The University of Massachusetts-Amherst, for example, has committed to a plan to procure 100% of food locally (Small, 2012). Further increasing local procurement can help establish trusted and transparent relationships with UBCFS' food suppliers. One way of doing so would be to create a platform to purchase directly from local producers, which would enforce reporting measures to monitor product sustainability.

4.3 Successes, Challenges, and the Future of UBC's Food System

Our interviews revealed a set of challenges in creating a CFFS specific to UBC. Figure 8 shows that there has been a lack in educational outreach. Many students, staff, and faculty may be unaware of the work that has and is being done by UBCFS. Further, as an institution of higher education, the potential to educate consumers and shift behaviour is large but is being underutilized. Advertising is one medium that can help explain the workings of a CFFS at UBC and educate consumers about how to participate with it. Some recommendations from the respondents included participation in the Good Food For All Campaign and the Good Food Challenge as a means to connect students to university administration (J. Schellenberg, personal communication, March 13, 2020), and publishing short informative videos on social media (D. Stancer, personal communication, March 13, 2020).

Another key challenge identified in the interviews and our analysis of procurement and sales data is the lack of a system that tracks and reports relevant food data in a comprehensive way. Schellenberg explains that third party evaluators such as Meal Exchange, , can offer a non-biased assessment of food system sustainability, and require less UBC staff capacity than self-reporting structures like the AASHE STARS program (personal communication, March 20, 2020). In collecting emissions data, inconsistencies and sometimes conflicting data make it challenging to analyze results for reporting (C. Repka, personal communication, March 6, 2020). Work must continue in creating a database of food based GHGe that can be easily used to measure the emissions output of food procured by UBC and potentially at other institutions, corporations, and municipalities.

Despite the many challenges in this new domain of CFFS, all respondents were able to comment on the successes of the UBCFS. A past challenge faced by UBCFS has been the lack of plant-based chef training in the industry. UBCFS has been a leader in this aspect as they now provide plant-based training for chefs on-site. This requires a significant investment of resources, and exemplifies the caliber of commitment to a CFFS. There has also been success in adhering to plant-based recipe guidelines, committing to Ocean Wise seafood, and working with SEEDS. In fact, UBC has been described as a leader amongst institutions in Canada food sustainability (J. Schellenberg, personal communication, March 20, 2020). If UBC continues on the current track of their successes and addresses the challenges we have identified, the goal of a CFFS can be better achieved and other institutions can follow suit.

Moving forward it is critical that the principles of CF food enacted by UBCFS are supported by the larger University administration. The global initiatives and guidelines we identified show how important it is to campaign for CF food on all scales and involve stakeholders from all aspects of the system. Although the University has officially declared a climate emergency, it is vital that

UBC includes the food system in policy and future plans. By involving the University in initiatives like the Cool Food Pledge and Meal Exchange's Good Food Challenge, or adopting effective policy standards and targets as described in Friends of the Earth Meat of the Matter guide, UBC can demonstrate leadership through a climate-friendly food system, sharing good practices and inspiring change among other Canadian universities.

4.4 Data Limitations

Our analysis of the secondary data was encumbered by several limitations because the data provided to us consistently lacked vital information or presented conflicting data. Sales and procurement data were spread across numerous files and compiling it in order to accurately analyze it proved to be quite challenging. Spend amounts with certain food suppliers differed across certain spreadsheets, and some data was missing for the years of 2016 and 2017 in the categorical breakdown of UBCFS food spend. Due to this and due to how some of the data was grouped in that breakdown, we had to make numerous assumptions in order to analyze the data.

The sustainability reports often lacked sufficient data about the indicators that were of greatest interest to our team. The largest suppliers of dairy and poultry provided sustainability reports but the metrics for the indicators were not filled out. It was assumed that in this case, the lack of response indicated that the data was unavailable. However, in some of the other reports it was assumed that the lack of a response meant that the indicator was definitely not fulfilled. These assumptions had to be made on a case-by-case basis because the formatting and context of each report varied. Another inconsistency was that one of the minor suppliers of produce, dairy, and grocery reported using a local radius of about 240 km, whereas the others used a radius of 400 km. This data was still included in the analysis but also contributes to the results in Figure 4 being underestimated. Another limitation of these sustainability reports was that we only had the data for the year 2018, so we could not conclude whether procurement in

relation to sustainability indicators has changed over time.

We were provided with other data that may have been more useful in assessing the climate impact of the UBC Food System, but this information was too incomplete to be included in a comprehensive analysis. This was in part due to the limited processing capacity of the procurement database. As students we did not have direct access to the database, our requests had to be processed and sent back to us which was limiting due to the time constraints of our project. Additionally, many items were listed in units of weight that could not be accurately converted to a standard metric unit. For example, some meat, seafood, and produce items were purchased in 'crates', 'bunches', or other bulk units without equivalent weights. While an analysis of purchases by weight is a good way to relate procurement to emissions, these inconsistencies made it difficult for our team to do so. This is why our secondary data analysis focused on dollar amounts rather than weights, as the most complete data we had was organized based on funds spent on various food categories or specific items. These limitations indicate the need for a new procurement system which allows for accurate tracking of items procured in standard units of weight.

Analysis of primary data was limited such that each respondent may have had a different definition of different terms being used in answers, such as local and sustainable. This means that classifying data by using iterative coding may not have given the truest representation of themes discussed by respondents. The literal meaning of responses was used when interpreting data, again, this may have caused skewed interpretation from the intended meaning of responses. Furthermore, our small sample size of n=6 may not have provided enough depth in responses. Since respondents were working within the UBC campus food system, they may have had a biased point of view when answering questions, especially related to their work on improving the system.

4.4.1 Limitations due to COVID-19

The onset of the global COVID-19 pandemic caused a disruption in the normal operations of the UBC campus and selectively limited our research. Our team was scheduled to meet with UBC's Climate-Friendly Food Working Group to present our preliminary findings and recommendations. We were unable to meet in person due to social distancing protocols enacted by the University. However, we had a virtual meeting with our clients to present our initial ideas and circulated our presentation to the rest of the working group to obtain more feedback. Due to these unusual circumstances our communication with the clients and the working group was complicated, but we still received some valuable input that we were able to incorporate in our report. Primary and secondary data collection was also affected as the shift to online classes interfered with normal campus activity. We were unable to interview the procurement manager for UBCFS, whose insights would have been relevant and useful to the goals of this project. UBC dining hall operations were also impacted by the pandemic, and therefore we were unable to obtain a list of their complete menu offerings from Nutrislice for the month of March 2020 as planned. Additionally, Nutrislice does not store menu offerings for previous months on their website, which meant we were not able to assess menu items for ruminant products in previous months.

5. Recommendations

5.1 Recommendations for Action and Implementation

5.1.1 Recommendations for UBC Food Services

The first set of recommendations is oriented directly towards UBC Food Services. There are five core recommendations with various underlying actions, as seen in Table 6. These recommendations were drafted based on our research and data findings, and they align with our purpose, to advise the development of policies and guidelines that accelerate UBC's transition towards a climate-friendly campus food system. The first recommendation (FS-1) is to increase the procurement of foods that are low in GHGe while also prioritizing seasonal and local

foods. This includes increasing the procurement of plant-based foods and reducing procurement of animal products, especially ruminant products such as beef, lamb, and dairy. Focusing on the type of food that is being purchased, and prioritizing plant-based products is the most impactful method for reducing food system emissions (FAO, 2011; Weber & Matthews, 2008; Poore & Nemecek, 2018; Macdiarmid, 2014). Procuring seasonal foods can reduce food system emissions, while local food can help build food system resilience (Friel, 2009; Stehfest, 2009). This recommendation (FS-1) is in line with our third research objective, to develop food procurement guidelines to inform UBCFS. We also suggest that UBCFS food visions and values should include a section on climate friendliness which can help guide purchasing. Furthermore, UBCFS should prioritize purchasing from suppliers that share these values and are transparent about their food, including how it was grown or produced and where it was sourced from.

The second recommendation (FS-2) is to create a new system to track food-related GHGe on the UBC campus. Through our research and data analysis we came to the conclusion that the current procurement system is not properly set up to track and analyze the GHGe of various food categories. In order to shift towards a more CFFS, there is a need to accurately track the procurement of all food items in standard weights. This could be accomplished by redesigning the current procurement system and creating new staff positions whose role it is to track the climate impact of the food purchases made by UBCFS. If the University is not able to accurately track and report this data, then it becomes difficult to observe progress and know where to focus future efforts. The procurement guidelines set out by Friends of the Earth in their Meat of the Matter report include this as a key step in developing a climate-friendly food purchasing system (Hamerschlag et al., 2017).

The next recommendation (FS-3) is to implement nudging strategies and improved rewards programs for CF foods. Other institutions such as Stanford have successfully

implemented nudging strategies to improve the consumption of more CF foods (Stanford University, 2017) and one of our interview respondents also suggested using nudging strategies to shift consumer purchasing habits. One example of a nudging strategy is asking customers what kind of milk they would prefer in foods and beverages to shift consumption towards plant-based milks. Other examples include listing add on meat options last on menus, raising prices for these add-ons, and closing meat heavy stations in the food outlets early. Furthermore, there is potential to improve the current vegetarian point system that is in place by shifting it towards a vegan system that is more representative of a truly CF diet. We also suggest that UBCFS develop a labeling system which identifies CF food options. Our research shows that this is an effective method for educating consumers and shifting their purchasing habits (Liu et al., 2019; Stanford University, 2017).

We also recommend that UBCFS continue to train chefs on creating and developing delicious plant-based meals (FS-4). Through our interview process we discovered that this is one of the current challenges that UBCFS faces, and that it is key for them to ensure that their chefs are able to prepare plant-based meals that appeal to people with various cultural and dietary preferences (M. Baker, personal communication, March 5, 2020). This could help to further encourage consumers to try more plant-based options. Our final recommendation (FS-5) is for UBCFS to trial a 100% plant-based food (no animal products) outlet that focuses on making great dishes where veggies are the center of the plate rather than grains or meat. This outlet could also include some simple and affordable CF meals such as burgers, wraps, and sandwiches. This could serve as an example of what a more CF food outlet could look like and cultivate new consumer mindsets on campus when it comes to making conscious dining choices.

Table 6. Recommendations for action and implementation oriented towards UBC Food Services.

Code	Action	Responsible Parties	Potential Partners	Timeline
FS-1	**Increase procurement of foods low in GHGe that are local and seasonal.** ● Increase procurement of plant-based foods--source locally and in season when possible. ● Focus on reducing procurement of animal products, particularly ruminant products (eg. beef, lamb, and dairy). ● Offer more CF menu options which are culturally appropriate and affordable. ● Adjust the current food visions and values to incorporate a section on climate friendliness of the foods -- use that to guide purchasing. ● Purchase from suppliers that also share these values and support sustainable, CF agricultural practices.	UBCFS (SHHS)	Local producers such as the UBC Farm	Immediate (ongoing)
FS-2	**Create a new system to track food-related GHGe on campus.** ● There is a need to track quantities in weight to understand the GHG impact of different food categories. ● Create additional staff capacity to track data relating to climate impact and sustainability of purchases.	UBCFS (SHHS)	UBC Campus and Community Planning, Campus Sustainability	Mid to long-term (over the next few years)
FS-3	**Implement nudging strategies and improved rewards programs.** ● Examples of nudging: asking customers what kind of milk they would prefer in relevant foods/ beverages, listing "add on" beef options last on the menu, closing certain "meat heavy" stations early. ● Dining halls already have a vegetarian point system but it includes dairy products. ● Improve rewards programs like this to be more representative of a truly CF diet. ● Create a labeling system that identifies the more CF food options while emphasizing taste and nutrition.	UBCFS (SHHS)		Immediate (ongoing)
FS-4	**Continue to train chefs on creating delicious plant-based meals.** ● Ensure that chefs are able to prepare plant-based meals that appeal to people with various cultural and dietary preferences.	UBCFS (SHHS)		Immediate (ongoing)
FS-5	**Pilot a 100% plant-based food outlet.** ● Focus on making great dishes where veggies are the focus of the plate rather than grains/starches or meat. ● More quick CF meals like burgers, wraps, and sandwiches.	UBCFS (SHHS)		Mid to long-term (2-5 years)

5.1.2 Recommendations for Campus and Community Planning - UBC 2030 Climate Action Plan

This following set of recommendations is oriented towards UBC Campus and Community Planning. In particular, these recommendations are meant to inform future climate action planning processes such as the UBC 2030 CAP, which is in line with our project's purpose. There are four overarching recommendations which include a handful of critical actions, as seen in Table 7. The first recommendation (CA-1) is to establish a team whose task it is to assess the current GHG impact of the UBC campus food system. This would allow for the identification of priority reduction areas within the food system and the creation of new targets. The assessment should also include an easily replicable method and metrics that can be used to track trends over the years. This is a critical step and should be a top priority as it is difficult to transition

towards a CFFS without properly understanding the current state of the campus food system and where to focus efforts. This recommendation ties in with FS-2, as it will be much more feasible to assess the current GHG impact of the UBC campus food system with a procurement system that is set up to track such variables.

The next recommendation (CA-2) is a direct follow up of the first one. Based on the findings from the GHG impact assessment of the campus food system, the University should develop and enforce a CFFS framework which supports ambitious GHG reduction targets. This would require cooperation from stakeholders across the campus food system, including UBCFS and AMSFS. In line with our fourth objective, the CCFS framework would include food targets that will be incorporated into the UBC 2030 CAP. These targets include increasing plant-based menu items to 75%, reducing menu items with ruminant products to 30%, and continuing to prioritize local and seasonal foods across campus food outlets. These targets were chosen based on analysis of the current state of the campus food system and our research findings which suggest the transition towards a more plant-based food system is the most impactful method for reducing food related emissions (FAO, 2011; Weber & Matthews, 2008; Poore & Nemecek, 2018; Macdiarmid, 2014). We also suggest that the current Climate-Friendly Food Working Group should be expanded so that it could take on a major role in developing this CFFS framework and allow for sharing of knowledge and coordination of actions across the entire campus.

Our third recommendation (CA-3) is to create a new online platform that allows campus food outlets, as well as other local food outlets, to purchase products directly from local producers. This could fill the gap between producers and food outlets, allowing for more transparency on how and where food was grown/produced. It could also lead to increased procurement of local foods and menus that reflect the seasonality of those foods. The development of such a platform would require collaboration across the campus food system. One of our

interview respondents discussed the potential for such a platform and mentioned how it is particularly important since the loss of services such as Vancouver Farmers Market Direct (J. Scott, personal communication, March 6, 2020).

The last recommendation (CA-4) is to promote community education around food system sustainability and CF foods. This could include the development of a for-credit first year course that teaches students about sustainable food systems and their role in it. The course should be open to students from all faculties and engage them towards making dietary choices that are better for their health and the environment. Other universities have successfully implemented such courses and seen positive results in the

food purchasing choices of their students after they have taken the class (Jay et al., 2019). Another method to promote community outreach and education around CF foods could include the implementation of discount days, free food, and sampling. Furthermore, there is a need to increase the awareness around the UBCFS story and the efforts that have already been made to shift towards a more CFFS, as was mentioned by a few of our interview respondents. They also suggested the potential to use advertising, social media, and other marketing tools to help tell this story and better inform the campus community.

Table 7. Recommendations for action and implementation oriented towards UBC Campus and Community Planning.

Code	Action	Responsible Parties	Potential Partners	Timeline
CA-1	**Assess the current GHG impact of the UBC campus food system.** ● Establish a task team to quantify UBC food system emissions. Identify priority reduction areas and targets. Delineate a replicable methodology and metrics to track yearly trends.	UBC Campus and Community Planning - Campus Sustainability	UBCFS (SHHS), AMSFS	Immediate (ongoing over the next few years)

CA-2	**Create and enforce a climate-friendly food system framework.**
	● Using the findings from the food system GHG impact assessment, UBC should enforce a campus-wide CFFS framework to support ambitious GHG reduction targets.
	● Food targets for the 2030 CAP:
	  ● Increase plant-based menu items to 75%
	  ● Reduce menu items with ruminant products to 30%
	  ● Continue prioritizing local and seasonal foods
	● Expand the current Climate-Friendly Food Working Group or create a new collaborative board composed of students, faculty, and staff for knowledge sharing and coordination of actions.
		UBC Campus and Community Planning - Campus Sustainability, UBCFS (SHHS), AMSFS	Other food outlets on campus, Environmental and food related student groups on campus	Mid to long-term (3-10 years)

CA-3	**Create an online platform to purchase directly from local producers.** ● Fill the gap so that UBC and other local food outlets can easily purchase directly from producers, providing more transparency. ● Promote a common vision across UBC to source low GHG intensive foods that are in season.	UBC Campus and Community Planning - Campus Sustainability, UBCFS (SHHS), AMSFS	Other food outlets on campus, UBC Farm and other local producers, Vancouver Farmers Market	Mid to long-term (<5 years)
CA-4	**Advance community education on food system sustainability.** ● Create a for-credit first year course about food system sustainability ● Promote CF foods through discount days, free food, sampling, veggie food trucks. ● Increase awareness about the UBCFS story and the efforts made thus far to shift towards a more CFFS. ● Use advertising, social media, or other marketing tools	UBC Campus and Community Planning - Campus Sustainability, UBCFS (SHHS), AMSFS	Faculty of Land and Food Systems, UBC Farm, Student organizations such as Sprouts and Roots on the Roof	Immediate (ongoing over the next few years)

5.2 Recommendations for Future Research

Our research focused on lowering the climate impact of the UBC campus food system by reducing GHG emissions. However, as mentioned in our literature review, there are several other environmental impacts to consider such as soil and water degradation, loss of biodiversity, and energy use. Future research should consider how different foods and food categories influence these effects, and whether a shift in UBC's procurement strategies can mitigate them.

To implement targeted nudging strategies, it would be helpful to have a better understanding of the attitudes and demographics of consumers at UBC. For example, a wide-scale study of consumers at UBC's dining halls could reveal whether students from certain faculties are more likely to choose CF food or shift their dietary habits. The results would inform the type of educational campaigns that could be most

effective as well as the target demographics. It would also be useful to study the effects of nudging techniques as they are implemented at different UBC food outlets. This would confirm that nudging is actually working and provide more empirical data that does justice to the efforts of UBCFS in the transition to a CFFS.

Assessing menu offerings based on climate friendliness could increase understanding of the GHG impact of each item. Building off FS-3, further research could focus on piloting this project. The labelling could be implemented in both dining halls and online via Nutrislice. It would be interesting to assess the effectiveness of labelling in educating consumers and increasing consumption of low GHG impact foods. The results could inform UBCFS' approach to promoting and encouraging healthy and sustainable foods.

6. Conclusion

Climate change is one of the largest threats to global food security. Our current food systems have a large climate impact and are vulnerable to the shifting state of our planet. With the UBC's declaration of a climate emergency in 2019 (UBC, 2019), the University must take steps to prioritize a climate-friendly campus food system. A CFFS which focuses on reducing GHG emissions, increasing resilience and adaptability, reducing animal production, as well as addressing the growing global population can support health and environmental wellbeing. UBC's food system has made commendable efforts in recent years to embrace values which promote campus sustainability. UBCFS has taken a plant-forward approach to their menu offerings including training chefs to create delicious plant-based dishes. UBC can further its transition by building off of existing efforts, learning from leading research as well as institutional good practices and policies. To transition to a CFFS, procurement should focus on the type of food that is being purchased, including increasing the procurement of plant-based foods and reducing procurement of animal products, especially ruminant products such as beef, lamb, and dairy (FAO, 2011; Weber &

Matthews, 2008; Poore & Nemecek, 2018; Macdiarmid, 2014). Procuring seasonal foods can reduce food system emissions, while local food can help build food system resilience (Friel, 2009; Stehfest, 2009). UBC currently offers 46% plant-based offerings in its dining halls (Fu et al., 2020) which aligns with UBC's trajectory towards a CFFS. That said, ruminant products such as beef, lamb, and dairy which are high in GHG emissions are currently offered in approximately 63% of dining hall menu items. Establishing transparency between UBCFS and their food suppliers is crucial for information to be provided on the origin and production methods of each product. There is a lack of a system to efficiently track and report food data, often leading to gaps in data provided by the suppliers. This makes it difficult for UBCFS to ensure the sustainability and environmental standards of the products that they procure. Despite UBC's successes to date, there is an opportunity to increase educational outreach and consumer awareness to grain support for UBC's transition to a climate-friendly food system.

Based on our research and data findings, our recommendations advise the development of policies and guidelines to accelerate UBC's transition towards a climate-friendly food system. We suggest that UBC Food Services should; increase procurement of foods low in GHGe that are local and seasonal, create a new system to track food-related GHGe on campus, implement nudging strategies and improved rewards programs, continue to train chefs on creating delicious plant-based meals, and pilot a 100% plant-based food outlet. Our suggestions for the UBC 2030 Climate Action Plan are to; assess the current GHG impact of the UBC campus food system, create and enforce a climate-friendly food system framework, create an online platform to purchase directly from local producers, and advance community education on food system sustainability. By implementing these recommendations, UBC, as an institutional leader in sustainability, can help address the threats of climate change and inspire collaborative action to catalyze global change.

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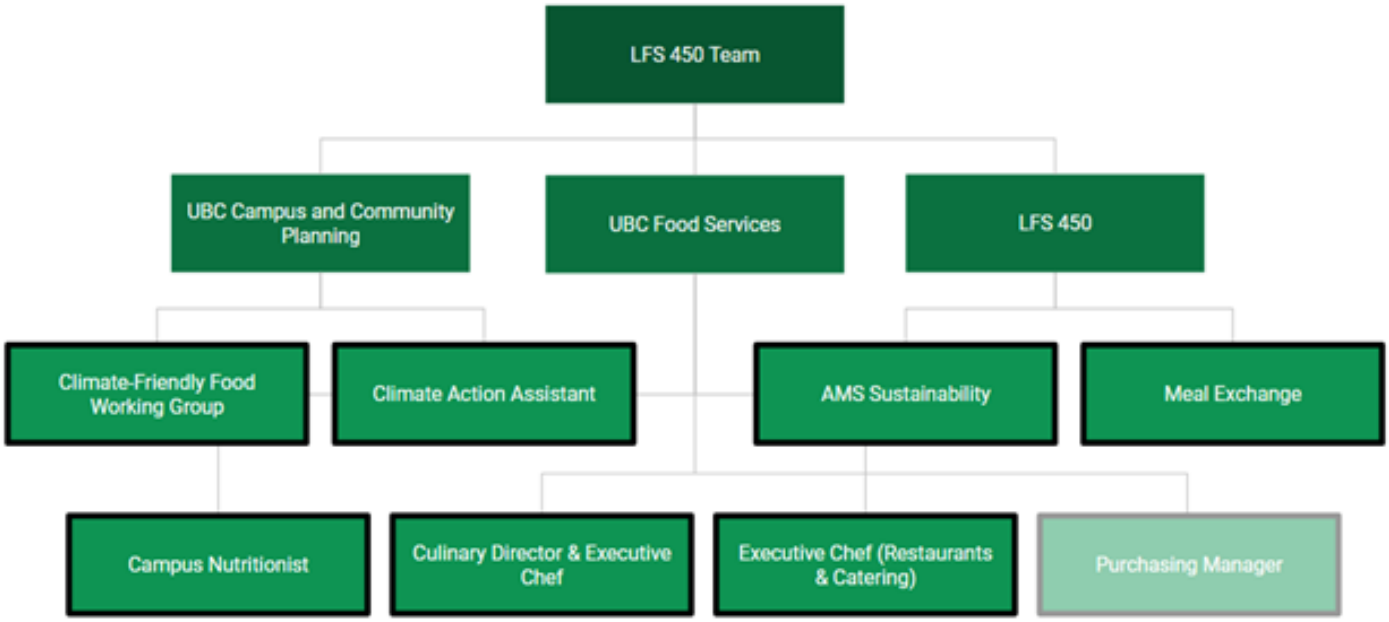
8. APPENDICES

Appendix A. Snowball recruitment strategy



Appendix B. Initial Contact Email

Dear_____,

My name is Jasmine and I am a 4th year undergraduate student in the Faculty of Land and Food Systems. I am part of an undergraduate research team that is exploring the sustainability of UBC's food system within the course "Land, Food, and Community III" (LFS 450). We are working with representatives from UBC Food Services and Campus and Community Planning to construct a set of recommendations that will propel UBC towards a climate-friendly food system.

I am writing to you today to invite you to participate in our study as we would greatly value your expertise and insight in regards to the aforementioned topics. This would include one semi-structured 30-minute interview at a location that is mutually convenient. The goal is to use this data to inform a set of sustainability-oriented recommendations for UBC Food Services as well as food-related targets for the UBC 2050 Climate Action Plan. Should you choose to participate, you will remain anonymous in our final report unless you consent to revealing your identity. You will have the right to withdraw from the study and have the interview records destroyed at any point, for any reason, until April 1st. Please see the attached document for additional information about the overall research objectives, ethical considerations, and a letter of introduction from the project's principal investigator/course instructor. By replying to this email, you are consenting to participate in this research project. However, please do not hesitate to contact me via email or by phone if you have any questions or concerns beforehand.

If you would like to participate in this research project, please reply with your availability for the next two weeks (March 2nd- March 16th).

Thank you for your time and I look forward to hearing from you!

Sincerely,

Jasmine Bal

Appendix C. Interview Questions

1. What does a sustainable/climate-friendly food system mean to you?

2. Based on our draft definition of climate-friendly food with key principles, how does this fit into your work or role in UBC's food system?

3. Where do you see room for improvement in terms of creating a more sustainable food system at UBC? Ex. highlighting the benefits to buying food that is local and sustainable

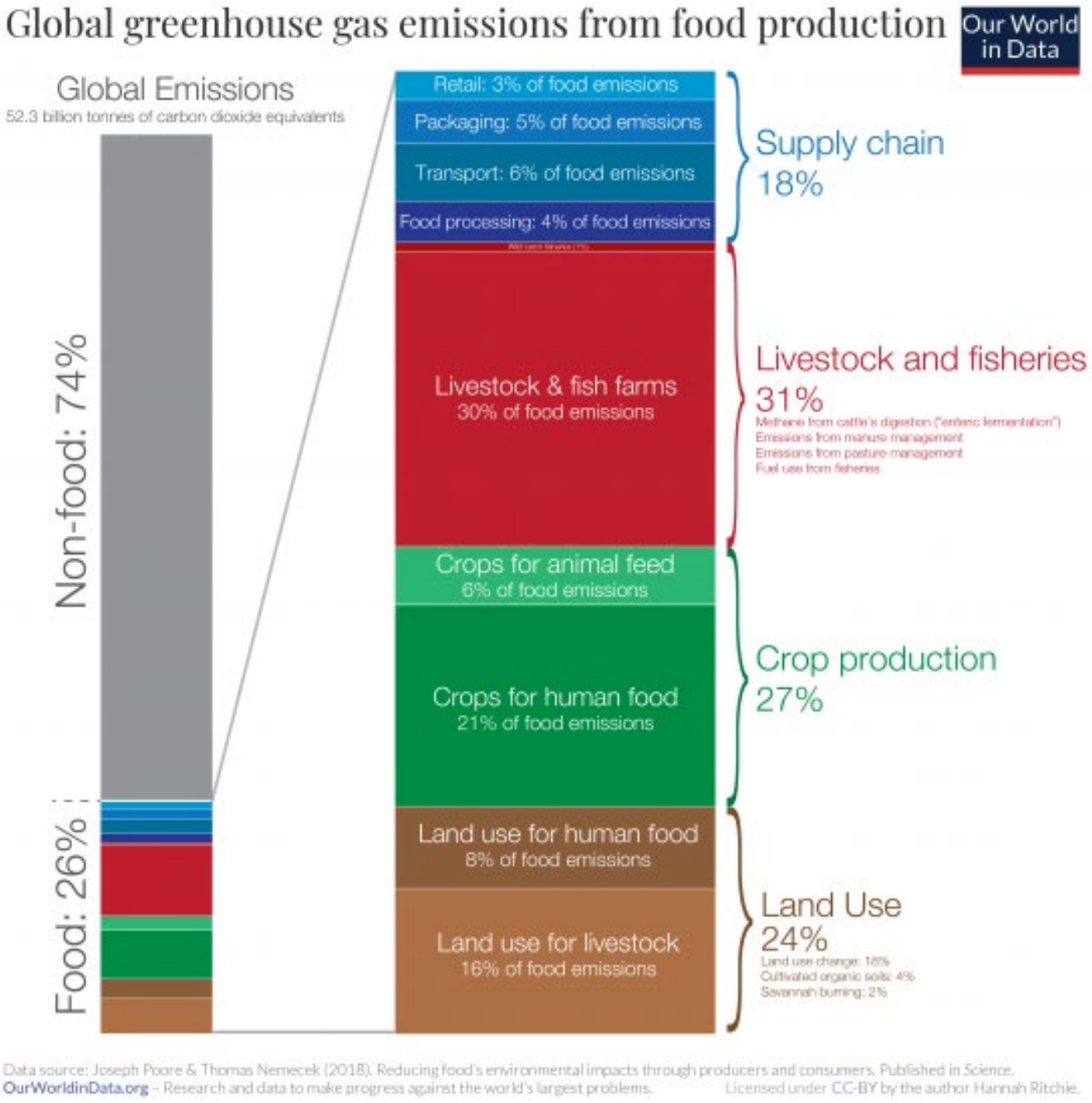
4. In your opinion, do you think UBC staff and students take into consideration the ethics of the food they buy? - difference between on campus and general

5. Do you have any suggestions for programs or incentives to encourage UBC staff and students to make climate-friendly food choices? (e.g. educational campaigns, meatless Mondays)

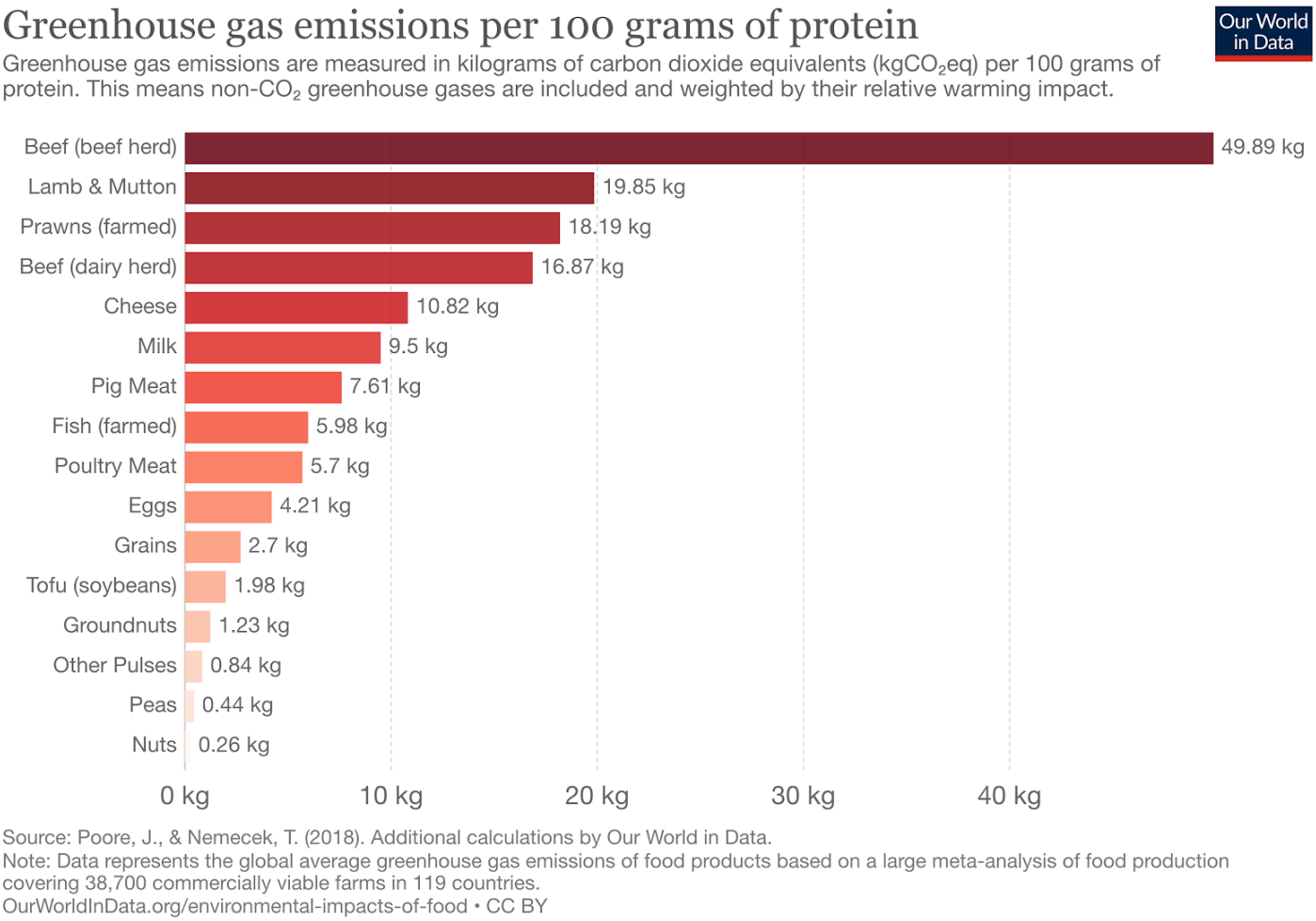
6. What do you think have been the greatest successes and challenges, in terms of the sustainability of UBC Food Services so far?

7. Is there anyone who you'd think would be beneficial to interview for this study?

Appendix D. Global greenhouse gas emissions from food production (Reprinted from Ritchie & Roser, 2020)



Appendix E. Greenhouse gas emissions per 100 grams of protein from various types of food (Reprinted from Ritchie & Roser, 2020)



Appendix F. Definitions for the various food categories found in the UBCFS procurement data

Food Category	Definition
Produce	Farm produced crops such as fruits and vegetables.
Grocery	Miscellaneous items such as rice, noodles, flour, oils, and spices.
Dairy	Products made from animal milk, such as butter, cheese, and yogurt.
Poultry	Products from domesticated birds (eg. chickens) such as their eggs or meat.
Meats	The flesh of animals such as beef, lamb, pork, and game (excludes poultry and seafood).
Beverages	Drinks such as juice, soda, and water.
Frozen items	Miscellaneous frozen items which could include soup, fruits, vegetables, and some animal products
Baked goods	Items that are baked in an oven, such as bread, cakes, and pastries.
Seafood	Various forms of sea life, including fish and shellfish.

Appendix G. Percentage changes in spend per food category between 2016-2018 derived from UBCFS procurement data (note that amounts are in Canadian Dollars)

CATEGORY	2016 SPEND	2017 SPEND	2018 SPEND
GROCERY	818790.3469	921388.9464	1290504.73
PERCENT CHANGE	-	*11.1%*	*28.6%*
PRODUCE	1375099.33	2553171.65	2323075.77
PERCENT CHANGE	-	*46.1%*	*-9.9%*
MEATS	926256.3293	1040374.474	968810.61
PERCENT CHANGE	-	*11.0%*	*-7.4%*
SEAFOOD	262685.05	384297.09	326355.32
PERCENT CHANGE	-	*31.6%*	*-17.8%*
POULTRY	695868.0963	1038033.771	1101031.09
PERCENT CHANGE	-	*33.0%*	*5.7%*
DAIRY	1076712.413	1305211.31	1385513.93
PERCENT CHANGE	-	*17.5%*	*5.8%*
BAKED GOODS	397251.3111	489853.1517	558068.03
PERCENT CHANGE	-	*18.9%*	*12.2%*
FROZEN	528255.8257	659866.9263	617854.82
PERCENT CHANGE	-	*19.9%*	*-6.8%*
BEVERAGES	1181334.15	1208941.21	771792.36
PERCENT CHANGE	-	*2.3%*	*-56.6%*
PAPER & DISPOSABLES	-	156615.85	124821.33
PERCENT CHANGE	-	-	*-25.5%*
SMALLWARES	-	-	104130.48
PERCENT CHANGE	-	-	-
TOTAL	**6765543.035**	**8984734.315**	**9343006.66**
TOTAL PERCENT INCREASE	**-**	***24.7%***	***3.8%***

Appendix H. Aggregated Data from 2018 Sustainability Reports including suppliers: Gordon Food Services, Centennial Foodservice, Freshpoint, Far-met Grocery, Albion Seafood, Saputo Dairy, and J&K Poultry

	Seafo	Mea	Produ	Dair	Grocer	Poult
Not local	$72,679	$567,30	$1,075,88	$485,88	$1,108,24	$313,01
Locally proce	$237,54	$218,20	$1,421.	$44,958	$101,592	$174.
Locally grov	$317,51	0	$317,513	0	$1,878.	0
Both	$152,48	$122,10	$140,270	$98,089	$28.54	0
Data N/A	-	-	-	$757,23	-	$756,86