The Default Veg Initiative:

Measuring and Reducing Food Emissions at the University of Victoria

Full Report - 2021

DEFAULTVEG

Sustainability in action.

University of Victoria
Campus Planning & Sustainability

Measuring and Reducing Food Emissions **3**

Metric 1: Food purchases *4*

Metric 2: Food-related GHG emissions *4*

Metric 4: Food-related carbon opportunity costs *5*

Understanding Food Emissions **6**

Food Emissions Reduction Strategies **7**

Food Initiatives at Other Universities *8*

Health Co-Benefits **9**

Campus Engagement **10**

Recommendations **10**

METHODOLOGY: PROJECT DESCRIPTION **13**

1 DATA SOURCES *13*

2 METHODOLOGY *14*

3 ASSUMPTIONS *17*

REFERENCES **18**

Appendix A: Cool Food Calculator Emission Categories and Sub-Categories **20**

Appendix B: Cool Food Calculator Food Item Classifications **22**

Appendix C: WRI Protein Scorecard **24**

Authors: Holly Cecil, MA; Nicole Fetterly, RD, MSc; Deanne Taillieu

The authors wish to thank Professor Maneesha Deckha in the Faculty of Law for academic oversight for this project, and to the following funding bodies at the University of Victoria: Campus Planning and Sustainability, the Animals & Society Research Initiative, and the Climate Solutions Challenge.

Further acknowlegments to DefaultVeg.org (Washington, DC) and the World Resources Institute – Cool Food Calculator. More information is available on the DefaultVeg at UVic website: oac.uvic.ca/defaultveg.

To cite this report: Cecil, H., Fetterly, N., & Taillieu, D. (2021). The DefaultVeg Initiative: Measuring and Reducing Food Emissions at the University of Victoria. University of Victoria, Office of Sustainability.

Measuring and Reducing Food Emissions

In the goal to identify and reduce our carbon emissions, it makes sense that how we fuel our bodies three times a day has a comparable impact to how we fuel our buildings and the vehicles we drive. Food systems are responsible for 25% of North America's greenhouse gas (GHG) emissions and therefore represent a significant sector in which to address mitigation strategies (Crippa *et al* 2021, 204).

The University of Victoria is setting strong carbon reduction targets, and by 2020 met its goal to reduce campus greenhouse gas emissions by 30 percent, relative to the 2010 baseline (University of Victoria, 2021). While reporting and reduction procedures are active for Scope 1 and 2 emissions, Scope 3 emissions – and in particular, food emissions – have until now remained unaddressed.

This project set out first to identify this need, winning recognition and funding from both the Campus Sustainability Fund and the Climate Solutions Challenge in 2021. We appreciate the generous participation of University Food Services and Executive Chefs from multiple food outlets on campus, who provided food purchasing data. Extrapolating from the autumn term 2019 as a baseline reporting period (the last fully-attended term on campus prior to the COVID-19 pandemic), our calculations show food emissions in 2019 to be 3,258 $tC0_2e$ (tonnes carbon-dioxide equivalent).

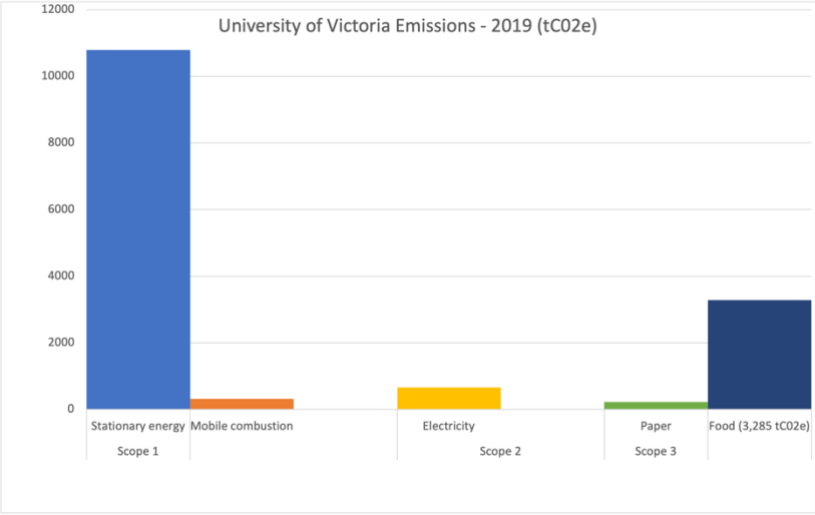


Figure 1: University of Victoria GHG Emissions, 2019. (Scope 3 Food Emissions from Metric 1: agricultural supply chains, not including land use change.)

Food systems are responsible for 25% of North America's greenhouse gas emissions, and therefore represent a significant sector in which to address mitigation strategies.

Emisssions Reporting:

Scope 1: Direct Emissions (generally natural gas, diesel and heating fuel)

Scope 2: Indirect Emissions (generally electricity, indirect emissions from the generation of purchased energy)

Scope 3: Indirect emissions from an institution's value chain, including both upstream and downstream emissions.

Metric 1: Food purchases

In the analysis period (September to December 2019) food purchases totalled 415,679 kg across campus operations. This extrapolates to ~1 million kg. of food over the 2019 year. Figure 1 displays the breakdown of purchases by weight, with fruits and vegetables dominating at 31 percent, followed by dairy at 22 percent.

Colour groupings designate red-, yellow-, green- and blue-tier food groupings, corresponding to the World Resources Institute Cool Food Calculator (Appendix 3).

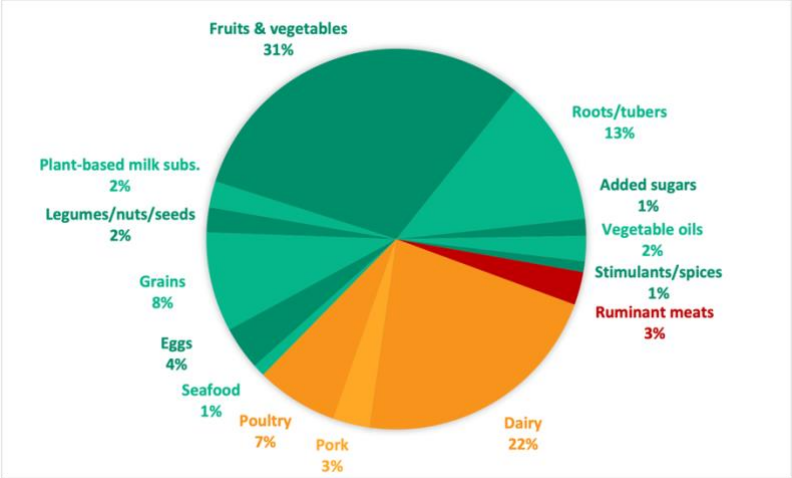


Figure 2: University of Victoria Food Purchases by Weight (Metric 1), cumulative for University Food Services, the University Club, and UVSS.

Metric 2: Food-related GHG emissions from the supply chain

As shown in Figure 3, this metric includes all upstream GHG emissions from agricultural supply chains (except land-use change). The 2019 emissions total from food on campus was 3,258 $tC0_2e$.

Emissions from green-tier, plant-based foods account for only 18 percent of emissions, while animal-based foods dominate with 82%. Note that red-tier ruminant meats comprise only 3% of food purchases by weight, but result in 34% of all emissions from food. Combined with dairy, they represent almost 60% of campus emissions from food. The red- and yellow-tier foods represent the categories in which to achieve the greatest emissions reductions.

"Ruminant meats comprise only 3% of food purchases, but result in 34% of emissions. Combined with dairy, they represent almost 60% of campus emissions from food."

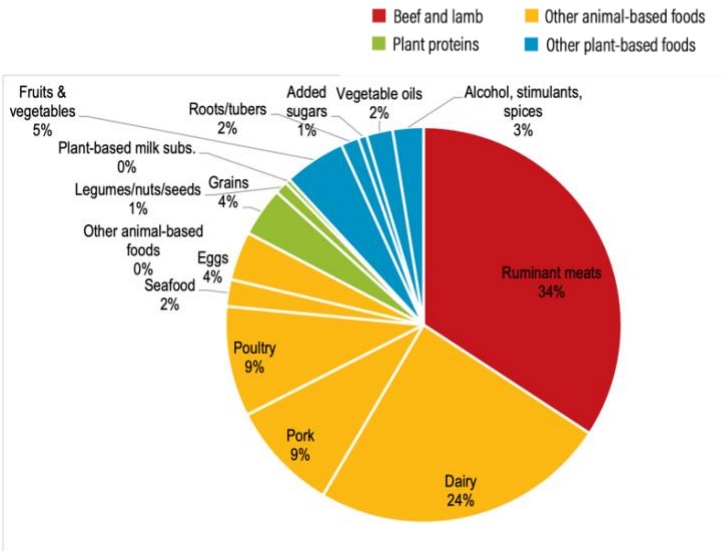


Figure 3: Emissions from the Supply Chain (Metric 2), University of Victoria Food Purchases (cumulative for University Food Services, the University Club, and UVSS, 2019).

Metrics 3 & 4: Food-related Land Use and Carbon Opportunity Costs

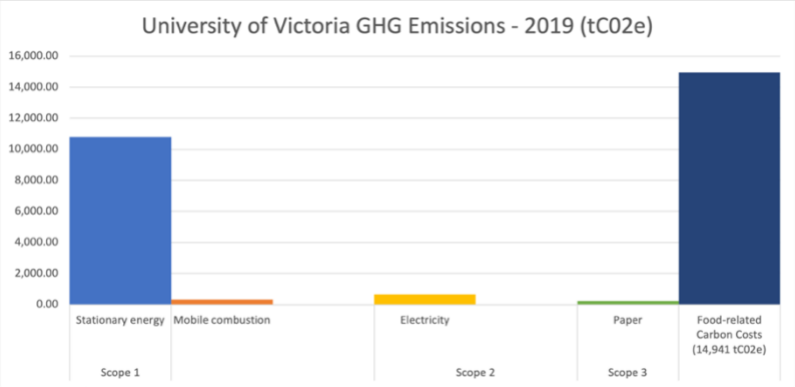


Figure 4: University of Victoria GHG Emissions, 2019. (Scope 3 Emissions from Food include total carbon opportunity costs, Metrics 2 and 4.)

Common evaluation methods of food-related GHG emissions do not fully reflect the carbon opportunity cost of using land for agriculture. The WRI Calculator provides additional metrics tracking food-related impacts to land. Land use, (Metric 3) for the University of Victoria totals 755 hectares for the 2019 year. Food-related carbon opportunity costs (Metric 4) are measured in tC02e and total 11,655 tC02e for 2019. Total Food-related Carbon Costs are calculated by adding Metrics 2 (emissions from the supply chain) and 4 (carbon opportunity costs) to arrive at 14,941 tC02e (see Figure 4).

Why do carbon opportunity costs matter? Between one-quarter and one-third of anthropogenic carbon emissions since 1750 are due to deforestation and other land-use changes, and the conversion of natural ecosystems to agricultural use remains a major contributor to climate change (IPCC 2019). The carbon opportunity costs per kilogram of each food item reflect the amount of carbon that could be otherwise stored on the lands currently used to produce that food. Because animal-based foods (especially ruminant meats) require a relatively large amount of land to produce a kilogram of food, these foods have higher carbon opportunity costs per kilogram.

The carbon opportunity cost of a food is calculated by estimating total global carbon losses caused by producing that food to date, divided by global annual production of that food, and the result is expressed in kilograms of CO_2e per kilogram of food (Searchinger et al., 2018; Waite, Vennard & Pozzi, 2019, p. 15). Carbon opportunity costs provide a fuller picture of the climate impacts of food production and consumption, and also that the climate benefits of shifting high-meat diets toward plant-based foods are larger than commonly calculated. Co-benefits beyond forests and the climate include UN Sustainable Development Goals such as hunger, healthy lives, water management, and sustainable production and consumption (Willett et al., 2019). To achieve a sustainable food future, the global food and agriculture system must increase the food supply by more than 50 percent while halting deforestation and reducing emissions by at least two-thirds (Waite et al., 2019).

Deforestation for Agriculture. Image: David MacLennan, Geograph.org.uk (CC0).

Understanding Food Emissions

Most agricultural supply chain emissions originate in the production process, from six sources (IPCC, 2019):

- "enteric" methane emitted from the stomachs of ruminant animals (cattle, buffalo, goats, and sheep);
- methane and nitrous oxide from manure management in confined animal facilities;
- nitrous oxide from animal wastes left on pasture;
- nitrous oxide from crop and pasture fertilization;
- methane from rice production; and
- carbon dioxide from energy use in on-farm activities and in the production and transport of agricultural inputs such as fertilizer.

Further upstream supply chain emissions arise from the following sources (Poore and Nemecek, 2018):

- transport of food and animal feed;
- food processing;
- food packaging; and
- losses during harvest, transport, processing, and packaging

The DefaultVeg Initiative, as well as the World Resources Institute (WRI) Cool Food Pledge, assists organizations to set a food-related greenhouse gas (GHG) emissions reduction target in line with the climate goals of the Paris Agreement (determined as a collective 25 percent emissions reduction by 2030 relative to 2015). The WRI Cool Food Calculator used in this analysis (see Appendix C) rates foods into red-, yellow-, and green-tier categories relative to their emissions intensity. Due to the intensive inputs in livestock agriculture, animal foods categories are responsible for the highest emissions factors. For example, in North America, the emissions factor for beef in the red-tier category is 41.35 kg $C0_2e$ for every kg purchased. The largest emissions reductions can be made by minimizing or excluding red- and yellow-tier categories in food services. Food savings will be a co-benefit of reductions in this sector, as animal-based foods are often the costliest.

Yellow-tier products are still of concern but less intensive than beef, with pork for example emitting 10 kg $C0_2e$/kg. Dairy products average 3 to 11 kg $C0_2e$/kg. Fish and poultry are approximately 5 kg $C0_2e$/kg.

Grains, legumes, vegetables and fruits, including plant-based proteins, are categorized as green-tier foods, with both the lowest emissions factors and costs. Legumes, for example, are factored between 0.7 and 1.7 kg $C0_2e$/kg.

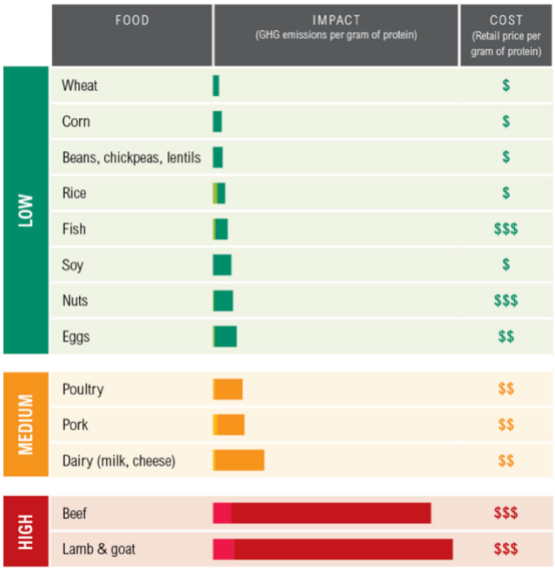


Figure 5: Protein Scorecard, Cool Food Calculator, World Resources Institute. See also Appendix C.

Food Emissions Reduction Strategies

Existing emissions reduction strategies at the University of Victoria have focused primarily on the concepts of waste reduction and purchasing food from local sources. However, local food strategies address only *transportation* emissions which on average comprise only 4% of a food's carbon footprint (Weber and Matthews, 2008).

The graph at right shows supply chain emissions for common foods. Transportation emissions, represented in red, are barely visible (See Figure 5). The bulk of emissions instead arise in the *production* phase, and are highest in animal-derived foods.

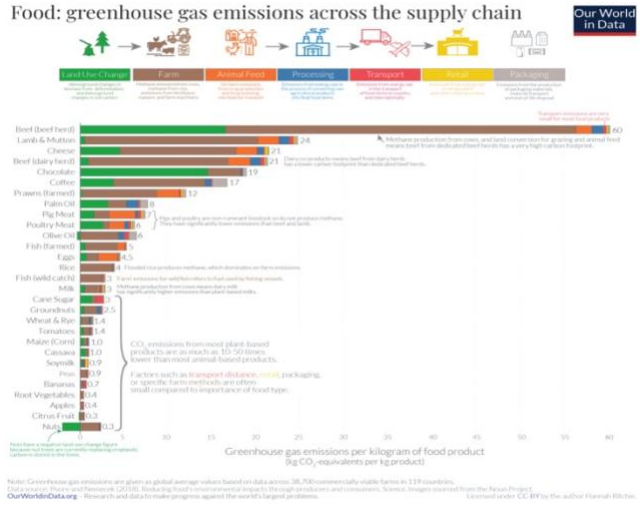
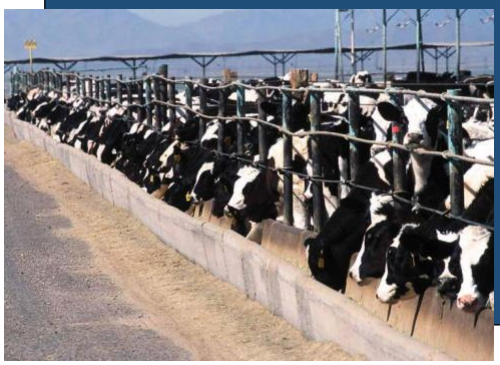


Figure 6: Greenhouse Gas Emissions per kg of Food Product. Source: Our World in Data



> *"Meat, aquaculture, eggs, and dairy use ~83% of the world's farmland and contribute 56 to 58% of food's different emissions, despite providing only 37% of our protein and 18% of our calories"*
>
> *– Poore and Nemecek, 2018*

The majority of food system emissions are attributed to livestock production, primarily due to inefficient conversion ratios, cycling food crops through farmed animals rather than consuming crops directly. Optimal reduction strategies therefore will reduce and eliminate the highest-emissions foods, whether locally sourced or not, and prioritize plant-based proteins. Scientists at the University of Oxford conducting the most comprehensive analysis to date of the damage farming does to the planet found that avoiding meat and dairy products was the single largest way to reduce humans' environmental impact (Poore and Nemecek, 2018).

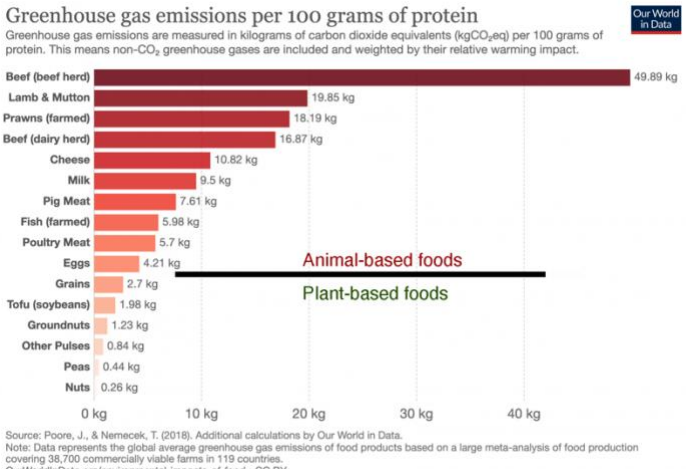


Figure 7: GHG Emissions per 100g of Protein. Source: Poore & Nemecek 2018; Our World in Data.

Food Initiatives at Other Universities

Transitioning to sustainable food systems is essential in order to deliver healthy diets to a global population of 10 billion estimated by 2050. As leading public institutions, universities are adopting recommendations by the 2019 EAT-Lancet Commission:

> "Transformation to healthy diets by 2050 will require substantial dietary shifts. Global consumption of fruits, vegetables, nuts and legumes will have to double, and consumption of foods such as red meat and sugar will have to be reduced by more than 50%. A diet rich in plant-based foods and with fewer animal source foods confers both improved health and environmental benefits."
>
> EAT-Lancet Report

Plant-forward menus are emerging as a key emissions reduction strategy in universities and institutions. In the UK, the **University of Cambridge** achieved a 30% reduction in food emissions by eliminating all ruminant meats including beef, and prioritizing plant-based menus since 2016. Significantly, they discovered this did not decrease their financial bottom line, creating a win-win for the University Catering Service, student satisfaction, and university emissions reductions. Read more on Sustainable Food at the University of Cambridge.

US Universities

As two examples, **Stanford University** menus prioritize plant-forward dining with over 50% plant-based offerings, with a further 30% fully vegetarian. At **Harvard University,** their Sustainable & Healthful Food Standards prioritize plant-forward menus.

Canadian Universities

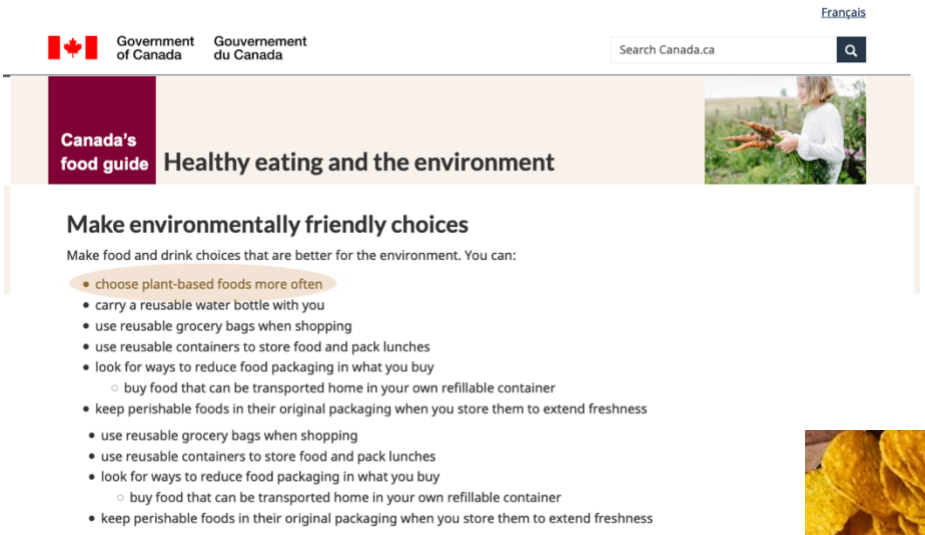
University of British Columbia
Executive Chef and Culinary Director David Speight leads UBC's plant-forward catering model. As of 2021, 50% of all entrees in residence dining are plant-based, with targets for 55% in their Winter 2021 semester menus. UBC Food Services is also launching the Climate-Friendly Food Label, part of the UBC Climate Action Plan 2030, which aims to position UBC as a model of how universities can mobilize to address the climate emergency and targets in the Paris Agreement.

Queen's University
Hospitality Services are prioritizing their menus with 43% plant-based offerings.

University of Guelph
The University of Guelph has developed the first Plant Based Nutrition certificate of its kind at a Canadian university. They have also transitioned their Child Care and Learning Centre to a 100% plant-based menu.

Health Co-Benefits

The 2019 revision of the Canada's Food Guide has shown a dramatic shift away from the former guide's recommendation for "Meat and Alternatives" and "Milk and Alternatives" as food groups and instead uses the terms "protein foods" and recommends they make up ¼ of the plate at each meal/snack. They also recommend to "choose protein foods that come from plants more often" as not only are they more sustainable, they have more fibre and less saturated fat which improves our health.



"Eat food, not too much, mostly plants"
– Michael Pollan

Prioritizing plant-based menus is a simple way to promote sustainability and wellness across campus. Plus, it recognizes the diversity of our university population and their dietary needs, making it easier for everyone to eat healthier meals and create a just world.

Overall, people who consume more plant-based diets and less animal foods have much lower risk of the majority of chronic diseases that reduce life span and are implicated in mortality rates here in Canada and globally including:

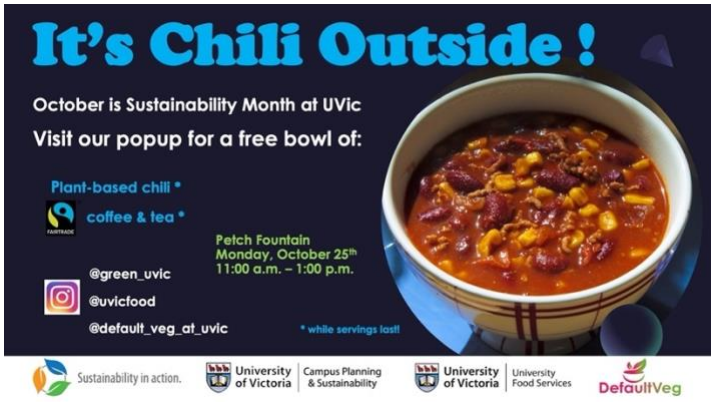
- coronary heart disease
- cancer
- stroke
- type 2 diabetes
- obesity
- cerebral vascular disease
- (Kahleova et al., 2020)

Campus Engagement

Chili Popup Event *serving hot plant-based chili and a bun to approximately 250 of our campus community, October 21st, 2021. [L to R: Nicole Fetterly (Project Director of DefaultVeg at UVic), Gordon World (Daiya Foods), and Siena Cecil (volunteer). Image: Holly Cecil.]*

An essential part of this project's analysis of UVic's Scope 3 food emissions on campus, and identification of winning reduction strategies, is the promotion of these strategies on campus.

Our successful **Chili Popup Event** October 21st, 2021 served hot plant-based chili and a bun to the 250+ visitors from our campus community, with Daiya plant-based 'ched shreds' served by Daiya Foods' Gordon World. The event promoted Fair Trade week, with free coffee, tea and cocoa served by the Office of Campus Planning and Sustainability.



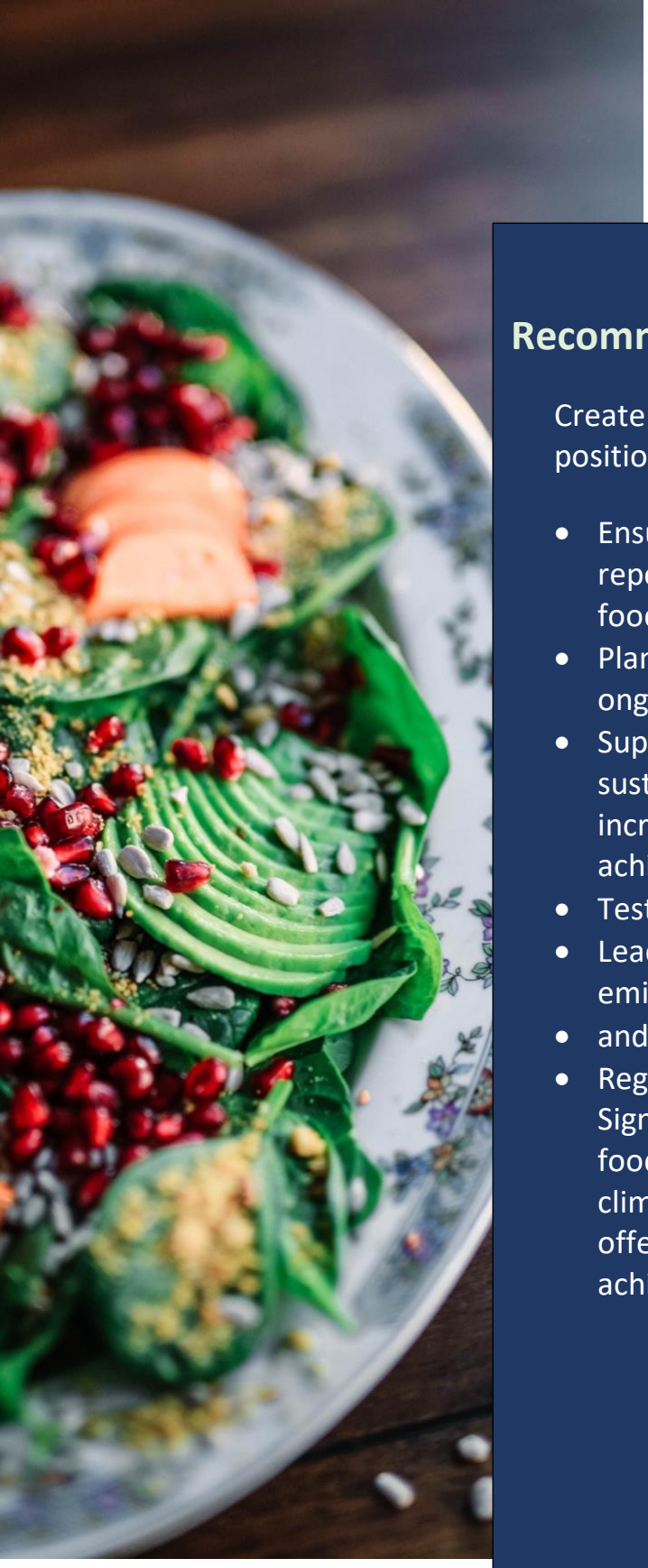
Online engagement includes the DefaultVeg at UVic Initiative website (oac.uvic.ca/defaultveg) and regular event, campus food highlights, and recipe postings to Instagram (@default_veg_at_uvic).

Recommendations

FOOD SERVICES – CAMPUS OUTLETS

This initiative recommends a 30% decrease in overall food emissions, employing the following strategies:

- prioritize green-tier, plant-based options as the ‘default’ across food outlets and catering
- list green-tier dishes first on menus and present first in serving order (Garnett et al., 2019)
- eliminate purchases of lamb (red-tier)
- reduce beef by 50% and substitute green- and yellow-tier proteins
- reduce dairy by 50% and substitute with plant-based ‘milks’
- remove add-on cost for plant-based ‘milks,’ make equal to or less than dairy at food outlets
- acknowledge impetus of pricing, make the sustainable green-tier choices the least expensive
- make green-tier items the 'default' as 60% of campus menus, with yellow- and red-tier food items the add-on/additional cost item



Recommendations: Sustainability

Create and hire permanent Campus Food Sustainability position to:

- Ensure ongoing measurement, analysis and reporting of Scope 3 food-related emissions from all food outlets across campus
- Plan next annual analysis for Term 3 - 2022 and ongoing, to plot reduction plan targets
- Support chefs and food services providers with sustainability knowledge, menu analysis and increased green-tier recipes and menu offerings to achieve GHG reduction targets
- Test and implement food-climate labelling
- Lead campus engagement with education on food emissions, fun food events
- and
- Register with WRI and the Cool Food Pledge. Signatories commit to a science-based pledge for food-related GHG emissions reduction, track the climate impact of food served, develop plans to shift offerings in a consumer-friendly way, and promote achievements

METHODOLOGY: PROJECT DESCRIPTION

This document serves to define the methodology for the tracking and calculation of food-related emissions from food purchased by the three major food providers on campus: UVic Food Services, the University of Victoria Student Society (UVSS) and the University Club, from September 2019 to December 2019, the last full term on campus prior to the pandemic and disrupting of operations.

The methodology for UVic food emissions was developed in May 2021 by Nicole Fetterly, Project Director of Default Veg at UVic, Holly Cecil, Project Coordinator for Default Veg at UVic, and Deanne Taillieu, Research Assistant for Default Veg at UVic ,with consultation from the Office of Campus Planning and Sustainability (Eleri Davies, Coordinator and Midhat Malik, Co-op Student).

1 DATA SOURCES

1.1 UVic Food Purchasing Data

UVic Food Services purchasing data is obtained from the Executive Chef/Associate Director for University Food Services, Tony Heesterman. Food purchasing data for the UClub is obtained from the Executive Chef/Acting Co-General Manager, Michael Allin. Food purchasing data for the UVSS is obtained from the UVSS food purchaser, Phil Bramhill. The data used in the calculations comes in the form of Excel spreadsheets from five suppliers (B & C Foods, Gordon Food Service, Islands West Produce, Saputo, and Sysco). Six suppliers were not included due to franchise status (Bento Sushi, Booster Juice, Hot House Pizza, Romeo's Pizza, Anar Foods, and Starbucks), and one was not included as it solely supplied single-serve items not included in the calculation (PSC Natural Foods). Six Suppliers were not included as weight information was unavailable (6 Mile Bakery, Cakes Etc., Eugene's, Kan's Gourmet, M & J Frozen Foods Inc., Portofino Bakery).

1.2 Emission Factors

The emission factors used in the calculations come from the Cool Food Calculator, developed by the World Resource Institute (WRI) for their Cool Food Pledge (WRI, n.d.). The emission factors used in the Cool Food Calculator are primarily derived from two recent global studies conducted by Poore & Nemecek (2018) and Searchinger et al. (2018).

Poore & Nemecek (2018) was a meta-analysis looking at the major environmental impact indicators of ~38,700 farms responsible for 40 agricultural products that collectively produces ~90% of global protein and calorie consumption. The emission factors used for the current project were for the total supply chain in the North American region. In total, forty-seven emission factor categories will be used for our calculations, found in Appendix A (WRI, n.d.).

1.3 Exclusions

1.3.1 Pepsi Products and Single-Serve Beverages/Food

Pepsi Beverages are not included in the calculations due to the standing agreement between UVic and Pepsi Bottling Group to provide beverage and vending services. This contract allows Pepsi to offer and market their products to campus populations, making it difficult to alter the beverage offerings on campus (Nestle, 2000). Pepsi also supplies single-serve, pre-packaged confectionary items that are excluded from the calculations for the same reasons. Single-serve beverages not supplied by Pepsi are also excluded from calculations as interventions targeted at reducing single use plastic have been shown to result in only marginal greenhouse gas reductions, while the substitution of beef for plant-based alternatives shows far greater improvements in the greenhouse gas impacts per person (Miller, 2020).

1.3.2 By-Products & Non-Categorical Foods

Other food items excluded from the calculations include any by-products, namely broth (e.g., beef, chicken, vegetable) clam nectar, and gravy. These products are not tracked as "GHG emissions are assigned to the primary products (e.g., meats)" (Waite et al., 2019, 25). Items that do not fit under one of the Cool Food categories (Appendix A) are also excluded from calculations. Some examples include white vinegar, baking powder/soda, and carbonated water. These items, referred to as non-categorical foods, are coded in the food purchasing spreadsheets with a red highlight across the row, indicating that they are excluded from further calculations.

2 METHODOLOGY

The following is a brief overview of the methodology used in the Default Veg project. All calculations are performed either in the purchasing spreadsheets provided by each supplier, the cumulative food purchasing spreadsheets created for each UVic food provider (e.g., Food Services, UVSS, UClub), or the Cool Food Calculator Excel spreadsheet. Each supplier-provided spreadsheet will be slightly different and thus the following methodologies are generalizations of the methods used.

2.1 Refine and Transfer Supplier Data

In the supplier-provided spreadsheets, convert the data provided into a table by selecting the appropriate columns/rows and inserting a table (if necessary). Once in table format, sort the item descriptions in ascending order. Next, identify duplicate items by highlighting the column containing the item descriptions and setting the "highlight cell rules" to "duplicate values" under the conditional formatting function. The data (e.g., price, amount ordered) for each duplicate item should now be combined. If the duplicate items were not ordered in the same unit (e.g., one is provided in kg, one is in L), leave them as two separate items. Calculate the total weight of each food item purchased by multiplying the pack, size and quantity purchased (if necessary). Keep the original unit provided, do not convert weights to kilograms at this stage.

In the appropriate UVic food provider spreadsheet, create a new tab labelled to reflect the supplier's name (Figure 5). In the new tab, create a table similar to that in Figure 5. If no meat or fish products supplied, the boneless column can be omitted. Next, input the following data (if available) from the supplier-provided spreadsheet: item description, total price, total amount ordered, and unit ordered in.

Cool Food Emission Categor	Supplier Description of Item	Boneless	Total Price	Total Amount Ordered	Unit	Conversion Factor (original unit to kg)	Reference Information for Conversion	Total Weight (kg)	Comments/Notes
Beans and pulses (dried)	BEAN CHICK PEAS GARBANZO	N/A	$ 159.70	85.2	L	100 mL = 101.4 g	Canada Nutrient File, Food code: 3279	28.80	
Beans and pulses (dried)	BEAN GRN PICKLED SPICED	N/A	$ 29.16	8	L	100 mL = 101.4 g	Canada Nutrient File, Food code: 2016	2.70	
Beef & buffalo meat	BEEF TOP SIRLN BUTT 1/4IN AAA CRSB FRSH	Yes	$ 2,759.28	198	KG	N/A	N/A	198.00	
Butter	BUTTER PATTY SALTED	N/A	$ 650.61	90	LB	1 lb = 453.6 g	Canada Nutrient File - Users Guide (Table 1)	40.82	
Butter	BUTTER PRINT SALTED	N/A	$ 883.35	81.72	KG	N/A	N/A	81.72	
Cheese	CHEESE BLUE WHEEL DANISH HALAL	N/A	$ 187.86	12	KG	N/A	N/A	12.00	
Cheese	CHEESE BOCCONCINI LARGE 100G	N/A	$ 60.88	4	KG	N/A	N/A	4.00	
Cheese	CHEESE BOCCONCINI MINI 5G	N/A	$ 449.55	27	KG	N/A	N/A	27.00	
Cheese	CHEESE BRIE BUFFALO	N/A	$ 771.81	21.6	G	1 gram = 0.001 kg	N/A	0.02	
Cheese	CHEESE BRIE DANISH	N/A	$ 42.99	1.5	KG	N/A	N/A	1.50	
Cheese	CHEESE BURRATA ALLA PANNA POUCH	N/A	$ 123.08	96	OZ	1 ounce = 28.35 g	Canada Nutrient File - Users Guide (Table 1)	43.55	
Cheese	CHEESE CHED IRISH W/GUINESS	N/A	$ 348.65	22.5	KG	N/A	N/A	22.50	
Cheese	CHEESE CHED MILD COL HALAL	N/A	$ 127.60	9.08	KG	N/A	N/A	9.08	
Cheese	CHEESE CHED OLD COL HALAL	N/A	$ 316.08	27.24	KG	N/A	N/A	27.24	
Cheese	CHEESE CHED SMKD APPLEWOOD WOC	N/A	$ 397.41	24	KG	N/A	N/A	24.00	
Cheese	CHEESE CREAM HERB GARLIC BOURSIN	N/A	$ 272.45	9	KG	N/A	N/A	9.00	
Cheese	CHEESE CREAM PLAIN TFC	N/A	$ 392.61	207	KG	N/A	N/A	207.00	
Cheese	CHEESE CURDS FIRM UNRIPENED PORT FZN	N/A	$ 87.64	6	KG	N/A	N/A	6.00	
Cheese	CHEESE FETA CRUMBLED	N/A	$ 156.84	12	KG	N/A	N/A	12.00	
Cheese	CHEESE GOAT CHEVRE LOG FRSH	N/A	$ 37.34	2	KG	N/A	N/A	2.00	
Cheese	CHEESE GORGONZOLA SMOKED WHEEL	N/A	$ 92.43	4	KG	N/A	N/A	4.00	
Cheese	CHEESE GRUYERE SMK PROC	N/A	$ 521.60	32	KG	N/A	N/A	32.00	
Cheese	CHEESE HAVARTI JALAPENO CREAMY HALAL	N/A	$ 176.89	12.6	KG	N/A	N/A	12.60	
Cheese	CHEESE PARM PURE SHRED 31PCT HALAL	N/A	$ 757.80	40	KG	N/A	N/A	40.00	
Poultry (chicken, turkey)	CHICKEN BRST 6Z BNLS SK/ON T/OUT FRSH	Yes	$ 3,793.67	290	KG	N/A	N/A	290.00	
Poultry (chicken, turkey)	CHICKEN TENDER LOVE ME TENDER BRD 80-90C	Yes	$ 864.45	60	KG	N/A	N/A	60.00	

B&C | GFS | Saputo | Sysco | Islands West | +

Figure 8: Example layout for UVic food provider spreadsheet.

2.2 Data Preparation for Cool Food Calculator

2.2.1 Weight Calculation

The next step, if necessary, is to convert the total weight of each food item purchased from its original unit into kilograms. The relevant conversion equation is listed in the column titled "Conversion Factor (original unit to kg)", with the reference information for this conversion factor listed in the column titled "Reference Information for Conversion". Finally, in the column titled "Total Weight (kg)", the total weight (original unit) is multiplied by the conversion factor to calculate the total weight of each food item in kilograms. In many cases, the conversion factor can be found using the Canadian Nutrient File (CNF). CNF is a comprehensive database for Canadian foods that includes weight conversion information for over 5690 foods (Health

Canada, 2021). If CNF is used as a conversion factor, the food code of the item is logged as a reference.

When calculating the weights of food items, some issues may arise. In the case of missing weights or unmeasurable units (such as “each”, “case”, etc.), the respective UVic food provider will be contacted to help fill in the missing information. Additionally, since legumes are known to triple in weight when cooked, the total weight of items containing cooked legumes classified under the category of “beans and pulses (dried)” will be divided by 3 to get the approximated dried weight. Plain beans that were reported using kilograms are assumed to have been purchased raw and are therefore not divided by 3. Items such as chili and hummus that are reported in kilograms will still be divided by 3 as they contain cooked beans and pulses. For weights provided in volume where a conversion factor could not be found on the CNF, an approximate conversion factor of 1 mL = 1 g was used.

2.2.2 Food Classification

Following the weight calculation, food items are classified into the appropriate emission category. A comprehensive list of the categories used for the Cool Food calculator can be found in Appendix A, with specific examples of food item classifications in Appendix B. The food items should be manually sorted into the categories based on their primary ingredient at the discretion of the researcher. Food items containing multiple ingredients will not be separated into percentages by weight as this information is not available from manufacturers and would result in inaccurate reporting. For example, although hummus contains multiple ingredients it is categorized as 100% chickpeas, rather than 75% chickpeas and 25% tahini.

For mixed items, the ingredient chosen to classify the food items is, by default, the first ingredient listed in the products ingredient list as it accounts for the greatest weight within the product. However, if the first ingredient is not the highest emitter, the item may be classified using the highest emitting ingredient as long as it falls within the first 5 ingredients listed, as these ingredients contribute significantly to the overall weight of the item. The highest emitting food within a product can be determined using the WRI’s protein scorecard (seen in Appendix C; WRI, 2016). A summary of the classification decision process can be seen in Figure 6. It is important to note that if a by-product (e.g., chicken stock) or non-categorical item (e.g., vinegar) is listed as the first ingredient, it will be disregarded and the second ingredient will be

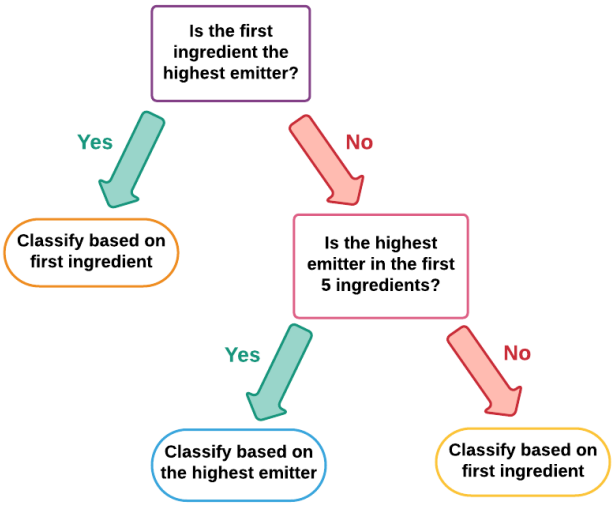


Figure 9: Cool Food classification decision process

considered as the first ingredient. If an ingredient list is not available, the researcher can assign a category based on a similar product.

2.3 Cool Food Calculation

Next, within each UVic food provider spreadsheet, the total weights for each Cool Food emission category should be summed to create an overall food purchase weight (in kg) for each category. Additionally, for the meat and seafood categories the percent of the food items that are boneless should be calculated. The sums of the weights (in kg) for each category are then copied into the Cool Food Calculator spreadsheet in the "Inputs – Food Purchases" tab. The following five metrics are then calculated automatically based on the emission factors for North America:

Metrics	Term 3 2019 (analysis period)	Total 2019 (extrapolated)
1. Food purchases (kg, boneless equivalent)	415,679	964,266
2. Food-related GHG emissions from agricultural supply chains (tCO_2e)	1,416	3,258
3. Food-related land use (hectares)	325	754
4. Food-related carbon opportunity costs (tCO_2e)	5,024	11,655
5. Normalized metrics (per kg, per 1,000 kcal, and per optional additional normalization factor provided by member)	544	1,261

The food purchases of each major UVic food provider (Food Services, UClub, UVSS) will have their own emission totals, as well as a cumulative total for all three. This will allow for a more effective identification of food purchasing behaviour and related carbon emissions.

3 ASSUMPTIONS

It is assumed that the majority of the food purchased by UVic comes from five primary suppliers listed in section 2.1. The emissions factors for the region of North America are also assumed to be approximately equivalent to UVic's purchases. All food items were inputted the way they were purchased and assumed to be raw. The ingredients used for categorizing the food items accounts for most of the food item's weight and GHG emissions and is therefore an accurate representation of its GHG emissions. All fish and seafood products were assumed to be boneless. Additionally, when converting weights of fruits and vegetables, the weight for a medium sized item was used. For weight conversions using CNF, it was assumed that the conversion factor was representative of the item. Fruits and vegetables were classified culinarily as opposed to botanically, following classifications set by the U.S. Department of Agriculture (n.d.).

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Appendix A: Cool Food Calculator Emission Categories and Sub-Categories

Main Category	Sub-Category
Ruminant meats	Beef & buffalo meat
	Lamb/mutton & goat meat
Other meats	Pork (pig meat)
	Poultry (chicken, turkey)
Dairy	Butter
	Cheese
	Ice cream
	Cream
	Milk (cow's milk)
	Yogurt
	Eggs
Fish and seafood	Fish (finfish)
	Crustaceans (shrimp/prawns)
	Mollusks
	Animal fats
Legumes (misc.)	Beans and pulses (dried)
	Peas
	Peanuts/groundnuts
	Soybeans/Tofu
Grains/cereals (except rice)	Corn (Maize)
	Oats (Oatmeal)
	Wheat/Rye (Bread, pasta, baked goods)
	Rice
	Tree nuts and seeds
Plant-based milk substitutes	Almond milk
	Oat milk
	Rice milk
	Soy milk
Fruits (misc.)*	Apples
	Bananas
	Berries
	Citrus Fruit
Vegetables (misc.)	Cabbages and other Brassicas (Broccoli)
	Tomatoes
	Onions and Leeks
	Other vegetables
Roots and Tubers*	-
Sugars and sweeteners*	-
Vegetable oils*	Soybeans (Oil)
	Palm (Oil)
	Sunflower (Oil)

	Rapeseed/canola (Oil) Olives (Oil)
Stimulants	Cocoa Stimulants & Spices (misc.)

*Main category used in calculations

Appendix B: Cool Food Calculator Food Item Classifications

Cool Food Category	Common Name
Cabbages and other Brassicas (Broccoli)	Arugula Bok choy Broccoli Brussel sprouts Cabbage Cauliflower Kale Sauerkraut Sui choy
Tomatoes	Tomato
Onions and Leeks	Leeks Onions Shallots
Other vegetables	Alfalfa sprouts Artichokes Asparagus Avocado Celery Cucumber Eggplant Endive Fennel Fresh herbs (i.e. cilantro, basil) Gourds Lettuce/leafy greens (i.e. romaine, iceberg, spinach) Mushrooms Peppers (i.e. chili, bell) Pickles Pumpkin Radicchio Squash (i.e. butternut, acorn) Zucchini
Roots and Tubers	Beets Carrots Daikon Garlic Ginger root Horseradish Jicama Parsnips Potatoes/sweet potatoes/yams Radish

	Rutabaga Turnips
Fruits (misc.)	Apricot Balsamic vinegar Cherries Coconut Fig Grapes Mango Olives Peaches Pear Pineapple Plums Raisins Red wine vinegar Rhubarb White wine vinegar
Apples	Apples Apple cider vinegar
Bananas	Bananas
Berries	Blackberries Blueberries Cranberries Currants Gooseberries Kiwifruit Raspberries Strawberries
Citrus Fruit	Grapefruit Lemon Lime Oranges
Stimulants & Spices (misc.)	Capers Dried herbs (i.e. dried oregano) Mustard Seed (including the condiment) Vanilla extract

Appendix C: WRI Protein Scorecard