GHG Assessment Report
Carbon Footprint of Food Purchases McMaster University Hospitality Services Summary

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Methodology

Food Purchase Data

McMaster University supplied data on the weight of food purchases from the Fall 2019 semester (August 1 to December 31, 2019) due to the lack of purchasing volumes during Covid-19, categorized by animal species and food type. The full data set contained over 1400 items, from which 1081 unique foods in 52 categories were matched with environmental impact data. These were consolidated into 19 categories of meat, dairy, eggs, plant-based meat and dairy alternatives, plant proteins, grains, vegetables, and fruit. For a full list of the original categories, see Appendix A.

Greenhouse Gas Emissions Assessment

Greenhouse gas emissions of purchased plant and animal products were calculated using a "life cycle" approach that includes the energy and emissions required to grow crops and animal feed, as well as breed, house, transport, and process livestock at a slaughterhouse. Emissions from post-farm food storage, processing, packaging, and transportation to distribution centers are included using global averages. This life cycle emissions measurement approach is similar to the GHG Protocol Scope 3 carbon emissions standard. Emissions are reported as carbon dioxide-equivalent emissions (CO_2e), a unit combining carbon dioxide, methane, nitrous oxide, and other GHGs on a common basis. All GHG emissions are adjusted according to their warming effect relative to carbon dioxide over 100 years.

Limitations

This assessment includes several broad assumptions about the composition of purchased foods that limit its accuracy and precision. One problem is that the composition of multi-ingredient foods, like breaded meats, sweetened yogurt drinks, breakfast cereals, etc. was not available. Another challenge is that high-quality life cycle environmental impact data is only available for a limited number of crops and food categories.

Because of these limitations, foods were assigned to 52 categories based on their primary ingredient. For example, breaded meats were categorized by meat type and breakfast cereals were categorized as grains. The carbon footprint of these foods was then assumed to be equivalent to the primary ingredient. For foods with a high-impact primary ingredient, like breaded meats and sweetened yogurts, this may lead to a slight overestimate of the carbon footprint. The same process could underestimate the carbon footprint of foods with a low-impact primary ingredient, like breakfast cereals and filled pastas. Overall, due to the relatively low purchase quantities of mixed-ingredient foods, we expect these assumptions will not affect the broad conclusions from this assessment.

The data set of food GHG emissions was developed for use in the United States, with a focus on North American food production. Differences between Canadian and American production and consumption patterns (for example, the proportion and origin of imported meats and vegetables) could affect the accuracy of the carbon footprint estimates for individual foods. Overall, due to the relatively low purchase quantities of mixed-ingredient foods and the broad similarities between food consumption patterns in the United States and Canada we expect these assumptions will not affect the broad conclusions from this assessment.

From the initial list of 1400 food products, about 350 foods did not match available food emissions data. These items totaled 33.7 tons, or about 7% of all reported food purchases. These foods include condiments and spices that, because of their wide range of primary ingredients (including water, sugar, and tropical plants), are expected to have a wide range in GHG emissions. It is beyond the scope of this report to assess the GHG emissions from these foods, but we expect this assessment of the remaining 93% of McMaster University's food purchases will provide sufficient evidence for food- based emissions reductions.

Results

Data Summary

This assessment covers 503 metric tons of McMaster University's food purchases. Broadly, these consisted of vegetables (184 tons), dairy (110 tons), animal protein (meat and eggs, 78 tons), grains (63 tons), fruit (34 tons), plant proteins (plant-based meat, beans, nuts, tofu, etc., 9.7 tons), and plant-based dairy (2.8 tons).

Total food purchases for Fall 2019 represent 1,400 metric tons of GHGs, or 3.2 million pounds of CO_2 equivalent emissions. These include estimates of all the emissions from producing, processing, storing, and transporting food to the University, but do not include emissions from preparing meals on campus or operating dining facilities.

Table 1: Purchased weight (in kilograms and greenhouse gas (GHG) emissions (in carbon dioxide-equivalents) for each reported food type for the Fall 2019 semester. Totals and sums may appear to differ due to rounding. A more detailed breakdown is in Appendix A.

	Purchases		GHG Emissions	
	kg	%	kgCO$_2$eq	%
Beef	11,150	2.2%	370,000	26%
Pork	12,368	2.5%	71,000	5.1%
Poultry	35,588	7.1%	150,000	11%
Fish	2,851	0.6%	20,000	1.4%
Shellfish	2,457	0.5%	36,000	2.6%
Eggs	13,771	2.7%	31,000	2.2%
Milk	98,783	20%	320,000	22%
Cheese	7,613	1.5%	130,000	9.0%
Yogurt	3,731	0.7%	9,000	0.6%
Plant-based Meat	1,706	0.3%	4,000	0.3%
Plant-based Milk	2,797	0.6%	2,300	0.2%
Beans & Pulses	3,636	0.7%	14,000	0.5%
Peanuts	210	0.04%	400	0.0%
Nuts & Seeds	240	0.05%	-220	0.0%
Tofu & Tempeh	3,889	0.8%	8,000	0.6%
Bread & Grains	62,507	12%	41,000	7.3%
Vegetables	183,873	37%	88,000	9.3%
Fruit	34,7030	6.9%	19,000	1.8%
Vegetable Oils	21,409	4.3%	40,000	2.8%
ANIMAL TOTAL	188,311	37.4%	1,100,000	80.2%
PLANT TOTAL	314,971	62.6%	210,000	19.2%
GRAND TOTAL	503,282	100.0%	4,900,000	100.0%

PURCHASES

Vegetable Oil, 4%
Fruit, 7%
Beef & Lamb, 2%
Pork, 2%
Poultry, 7%
Eggs, 3%
Milk, 20%
Vegetables, 37%
Cheese, 2%
Yogurt, 1%
Plant-based Milk, 1%
Bread & Grains, 12%
Tofu & Tempeh, 1%
Beans & Pulses, 1%

GHG EMISSIONS

Fruit, 2%
Vegetable Oil, 3%
Vegetables, 9%
Bread & Grains, 7%
Beef & Lamb, 25%
Yogurt, 1%
Cheese, 9%
Pork, 5%
Milk, 22%
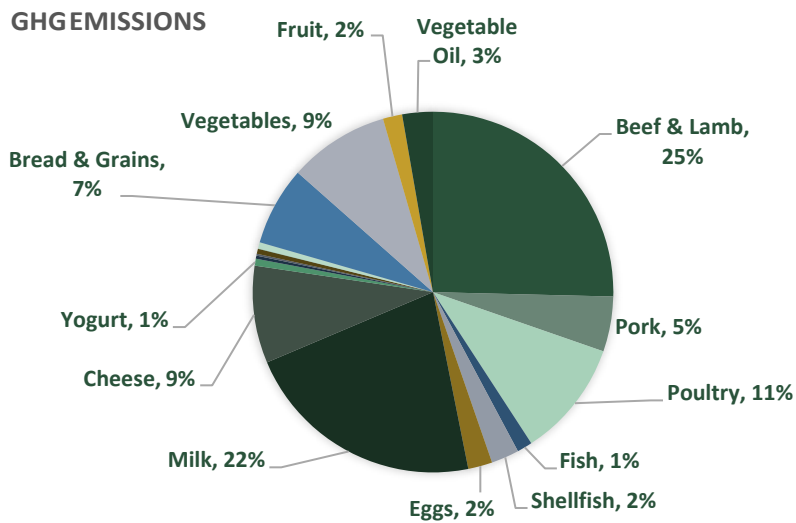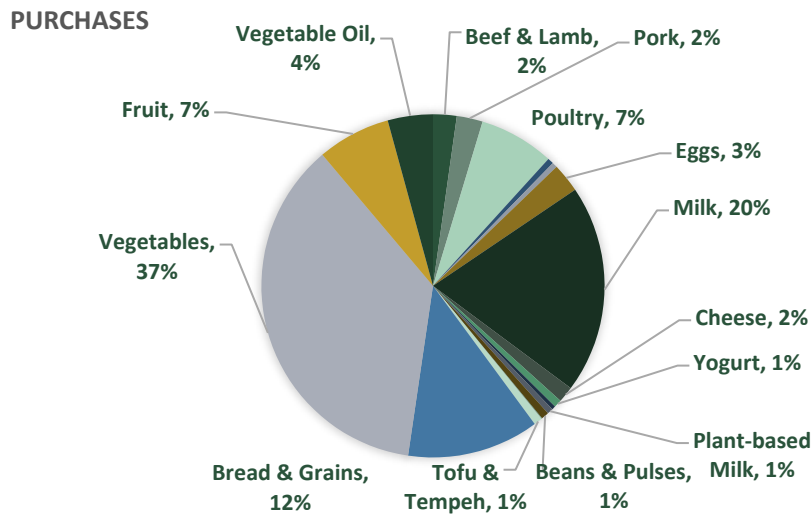Poultry, 11%
Fish, 1%
Eggs, 2%
Shellfish, 2%

Figure 1: Proportions of food purchases and GHG emissions by food category during the Fall 2019 semester at McMaster University. Food categories that represent less than 0.5% of the total in each chart omitted for clarity.

Appendix A

Table A1: Food purchases (Kg) and GHG emissions in each of 52 detailed food categories. For ease and clarity in reporting, these were consolidated into the 19 categories shown in Table 1.

Foods	Edible Weight (kg)	GHGs (kgCO$_2$e)
Animal	**188,311**	**1,129,768**
Beef	6,974	224,634
Beef (beef herd)	3,942	139,102
Butter	368	4,956
Cheese	7,585	125,745
Chicken	33,051	130,882
Chicken50Beef50	55	1,002
Crab	2	34
Cream	22,415	126,137
Duck	34	284
Eggs	13,068	30,646
Fish	59	450
Fish (caught)	168	875
Fish (farmed)	1,557	15,775
Lamb	206	5,420
Lobster	16	338
Mayonnaise	703	842
Milk	76,000	184,030
Pork	12,368	71,391
Scallop	65	492
Shrimp	2,375	35,266
Tuna	1,067	2,774
Turkey	2,503	20,908
Yogurt	3,731	9,035
Plant	**237,770**	**211,440**
Apples	3,332	1,366
Bananas	2,936	2,437
Beans & Pulses	3,636	6,494
Berries & Grapes	4,434	5,233
Beyond	232	820
Brassicas	11,130	8,014
Bread	8,187	13,180
Citrus Fruit	4,034	1,694
Corn	253	261
Grain	41,161	61,737
Groundnuts	210	397
Meat analogs	1,474	3,228
Mushrooms	3,214	9,940

Nut milk	514	216
Nuts	192	-267
Oats	266	728
Onions & Leeks	15,001	5,550
Other fruit	19,966	14,376
Other Vegetables	45,616	20,984
Potatoes	52,671	24,755
Rice	12,894	26,671
Root Vegetables	6,853	2,741
Seeds	48	47
Soy milk	2,084	1,604
Tempeh	27	41
Tofu	3,862	7,955
Tomatoes	27,726	18,576
Vegan mayonnaise	200	479
Vegetable Oils	21,409	39,691
Grand Total	**2,758,591**	**5,236,855**