Replicating the Nature Positive Universities Framework to Assess the Biodiversity Impact of Food Procurement at the University of British Columbia

Prepared For

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Introduction

Human activities associated with land, energy and water usage, including anthropogenic climate change, are driving rapid biodiversity declines in the world's sixth mass extinction (WWF, 2022). Unlike previous mass extinctions driven by natural phenomena, humans are responsible for the high, current losses of biodiversity. Food production contributes disproportionately to these losses. Forty percent of all land has been converted for food production, and agriculture is responsible for 90% of global deforestation. Food production also contributes significantly to GHGs emissions with today's supply chain creating ~13.7 billion metric tons of CO2 eq, which accounts for 26% of anthropogenic GHG emissions. On top of that, agriculture sucks up 70% of the world's freshwater, creates ~32% of global terrestrial acidification and ~78% of eutrophication, exacerbating climate change and its consequences on species composition and resilience (Poore & Nemecek, 2018; WWF, 2022).

Biodiversity encompasses the diversity in composition, structure and functioning of genetics, populations/species and communities/ecosystems (Redford and Richter, 1999) with numerous benefits to humans and non-human organisms alike (Cardinale et al. 2012). Thus, conserving and restoring the earth's biodiversity is vital to ensure a vibrant, healthy future which supports the intertwined relationships of living organisms, including humans. The adoption of a post-2020 global biodiversity framework by the UN Convention on Biological Diversity this past December (2022) sets an urgent agenda: halt and reverse biodiversity loss to achieve a nature-positive world by 2030 (IUCN 2022).

One way to reduce human-driven species loss is to focus on the significant environmental footprints of large organizations, including corporations and universities. For instance, the University of Oxford's greenhouse gas footprint rivals that of the Caribbean island nation of Saint Lucia (Bull et al. 2022a). The sizeable environmental impacts of universities and other large organizations represent an enormous opportunity to target biodiversity losses through assessing and modifying institutional practices.

In 2021, the University of Oxford launched an ambitious environmental plan to achieve net-biodiversity gain and net-zero carbon by 2035 (Bull et al. 2022a). To understand the actions needed to meet these goals, Oxford defined a conceptual framework to assess the environmental impacts of the University's activities. Activities included those related to research, education and operations of the University.

Data collected for each activity were converted into estimates of “mid-point environmental impacts” such as the amount of carbon dioxide emitted, land or water used, and air or water pollutants produced as a result of the activity. Oxford then converted mid-point impacts into “end-point” impacts which estimated the extent of biodiversity loss associated with the aforementioned environmental impacts (Bull et al. 2022a).

To increase the scope of their study, Bull et al. (2022a) called for other universities and other large organizations like multinational corporations and governmental institutions to apply Oxford’s biodiversity footprint assessment framework (including monitoring, reporting and reducing their biodiversity footprints) to their own operations. Following this original study, another group of researchers at Oxford, Taylor et al. (2023), proposed an approach to measure the biodiversity impacts of food consumption and to “achieve nature-positive targets” in this regard. The approach set forth by Taylor et al. (2023) details an explicit methodology used to assess Oxford’s food-related biodiversity impacts, providing a tangible starting point for other universities to evaluate their environmental footprints. Depending on how replicable Oxford’s framework (for food impacts and beyond) is at other institutions, their methodology and tools could help additional institutions set tangible, feasible and transformative goals to reduce their biodiversity impacts.

Oxford has in fact encouraged universities’ participation in biodiversity assessment and restoration activities through the Nature Positive Universities (NPU) global network, which is co-led by the United Nations Environmental Programme (UNEP). NPU aims to restore biodiversity harms of universities while enhancing their positive impacts on nature (Nature Positive Universities, 2022). As a part of NPU, the University of British Columbia (UBC) has committed to analyzing the impacts on biodiversity of their own operations. Oxford’s study found that most of the University’s negative impacts on biodiversity are due to activities it can only influence indirectly, such as food consumption—one of the university’s highest-impact activities (Bull et al. 2022a). However, food consumption can be greatly influenced by a University’s food procurement decisions, which are under its direct control.

In this study, we assessed the environmental impacts of UBC’s food procurement using Oxford’s conceptual framework (Bull et al. 2022a and Taylor et al. 2023). We looked specifically at the GHG emissions, land and water use, air and water pollution of food procured by UBC Food Services (UBCFS) outlets (including dining halls, restaurants, retail and catering) between January and December 2022. We used these impacts to estimate the extent of biodiversity loss associated with UBC’s food procurement activities and identify areas where UBC can reduce its negative impacts.

To improve the efficacy of Oxford’s assessment framework for future studies at additional universities and large organizations, we also evaluate the replicability of Oxford’s framework with UBC’s data and food procurement operations. We document the availability of food procurement data at UBC Vancouver as well as issues in obtaining and working with such data; describe challenges, gaps and successes encountered when following the methods developed at Oxford, and provide insights and tips for research teams conducting similar studies in the future. Based on the challenges and limitations we experienced throughout this study, we discuss potential policy changes for food vendors, UBCFS and UBC as a whole, to spur better data collection, organization, and availability, as well as more sustainable procurement decisions. Our policy suggestions can help UBC mitigate its biodiversity impacts, while our evaluation of Oxford’s framework will enable more robust future studies at additional universities.

Methods

Given that the central goal of this project was to replicate Oxford’s assessment framework, our methodology closely follows the methods of the original assessment while operating within the local constraints of the UBC context. Oxford’s framework systematically categorized environmental impacts, whereby activities could be grouped based on the types of features they involved, such as travel, food, the built environment, the natural environment, resource use and waste–and the environmental impacts associated with those features: greenhouse gas emissions, land and water use, and pollution of water and air. We focused on one activity, food procurement, and used existing food impacts data from previous life cycle analyses (Clark et al. 2022, Poore and Nemecek 2018) to assess UBC’s impacts in this aspect of its supply chain. Furthermore, while Bull et al. (2022a) created a distinction between activities that were either directly or indirectly under the control or influence of the University, we only explored the directly controlled activity of food procurement at UBC.

The food procurement data was obtained from the UBC SEEDS Sustainability Program, of which UBCFS was a collaborator. The data represented UBCFS’s procurement activities for the calendar year 2022, and encompassed purchases for all UBCFS outlets including three dining halls, two UBCFS-owned restaurants, retail, and catering. Excluding externally controlled food outlets, UBCFS is the largest food provider on the UBC Vancouver campus. Between the two main food services at UBC Vancouver, UBCFS and AMS Food Services, UBCFS is responsible for around 80% of combined food procurement.

In the initial data cleaning stage, we removed all non-food items (such as cleaning supplies, chemicals, equipment, or service fees). A total of 1317 unique food items, which could be identified by product ID, were ordered throughout the year. The dataset encompassed about 5024 distinct orders in total; this high number reflects that most items were ordered more than once. For efficiency, therefore, we decided to assign an equal number of unique items for each team member to analyze. As all products were already assigned to a category in the UBCFS dataset, each person received an equal proportion of products in every category. Each of the three team members was responsible for about 439 unique items.

Next, using the Oxford research team's impact calculation spreadsheet, we developed a procedure to calculate the estimated mid-point environmental impacts of each food item. The mid-point impacts were land use, eutrophication, acidification, water use, and greenhouse gas (GHG) emissions. In the spreadsheet, methods from Clark et al. (2022) and Poore and Nemecek (2018) allowed us to create impact estimates for each of the nearly 20,000 food items found in the Open Food Facts (OFF) database using the total weight (in grams) of a given food item and the best equivalent match in the OFF database. Since product weights were already available in the UBCFS dataset, the total weight for every unique product was calculated and converted into metric units where necessary. We were then able to search for and select the best item match in the OFF database.

Multiple potential matches were often available for a given food item. For instance, a search for "cornflour" results in six highly similar potential matches. To address this and be consistent in our selection processes, we developed shared guidelines in consultation with the Oxford team. In cases of ambiguity, we decided to use a conservative estimate by matching with the product with the highest combined impact. This composite impact score was calculated by summing the five mid-point impacts.

Once the mid-point impacts for the dataset were collated and summed, we used formulas provided by the Oxford study team to calculate end-point biodiversity

impacts. These formulas used a model called ReCiPe to translate emissions and other mid-point impacts into environmental impact scores, or end-point impacts. End-point impacts described the biodiversity metric of ecosystem quality, measured in units of local species loss integrated over time, a metric that revealed relative biodiversity impacts resulting from the aforementioned mid-point impacts on land, water and air. Local species loss refers to biodiversity decline which occurs local to the mid-point impacts of the supply chain.

In considering our impact results, we realized that the food categories in the dataset could be redefined to better demonstrate the different impacts of food types. For instance, we noticed that certain products were included in both the "beverages" and the "groceries" categories. Meats, meals, and vegetables were grouped together in a "frozen" category, despite that it was a storage method rather than product category. Additionally, the pre-existing categories did not align with those used by Bull et al. (2022a). Therefore, we decided to create new categories and re-code the items where necessary. For example, we added a "confections" category, and re-coded the "frozen" category so that products were categorized only by the type of food they represent. Table 1 below provides an overview of all the pre-existing UBCFS categories, the categories used in Bull et al.'s (2022a) study, as well as the newly redefined categories.

Table 1. Summary of pre-existing UBCFS categories, Bull et al.'s (2022a) categories, and new categories (newly created categories are indicated in bold).

UBCFS Pre-existing Categories	Categories in Bull et al. (2022a)	New Categories
Beverage	Beers, Wines, Spirits, Alcoholic drinks	Bakery
Beverage Systems	Bakery Products	Beverages
Dairy	Dairy	Dairy
Frozen	Produce	Legumes
Grocery	Groceries	Meat
Meat	Meat, Poultry, Offal	Poultry
Poultry	Soft and Non-alcoholic drinks	Produce
Produce	Fruits and Vegetables	Seafood
Seafood	Fish and Seafood	Snacks
	Confectionery, sweet and savory	Grocery

The resulting categories are bakery items (such as bread), beverages (including drink mixes and syrups), dairy (including eggs), legumes, meat, poultry, fresh produce, seafood, snacks and confections, and grocery. The “bakery” and “snacks” categories were created to better align with those used in the Oxford study (Bull et al., 2022a); the “legumes” category was created as legumes are often used as a protein-rich meat substitute. The “grocery” category served as a catch-all category for all items that did not fit into any of the other categories, such as pre-made meals and pantry ingredients.

Results

Absolute results

In 2022, UBCFS procured a total of 693,973 kgs of food, of which groceries (44.4%), beverages (26.1%) and dairy (10.8%) had the largest quantities by weight (Figure 1).

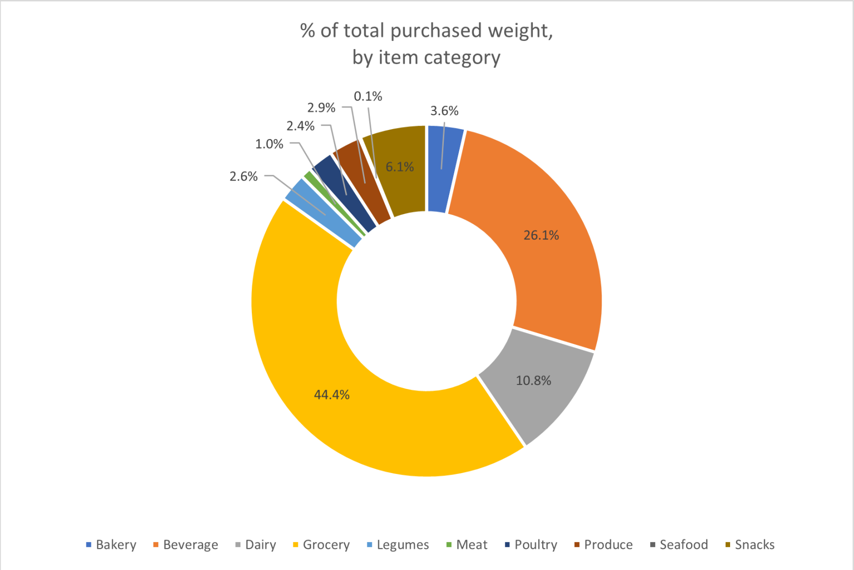


Figure 1.Percentage of total purchased weight by food category in 2022

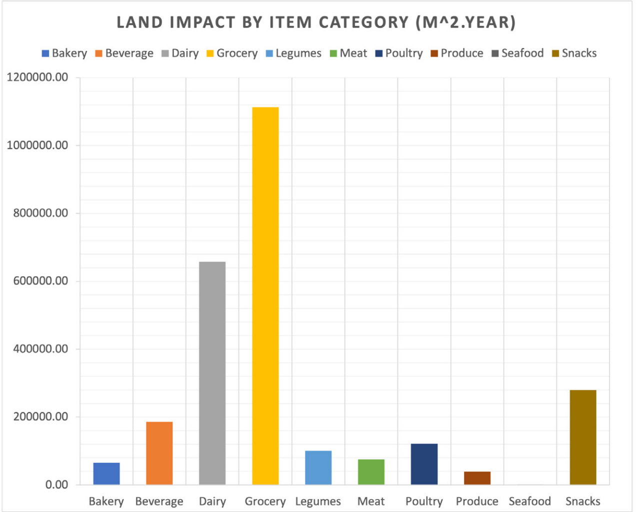
The absolute impacts of UBCFS food procurement on the five environmental categories are as follows:

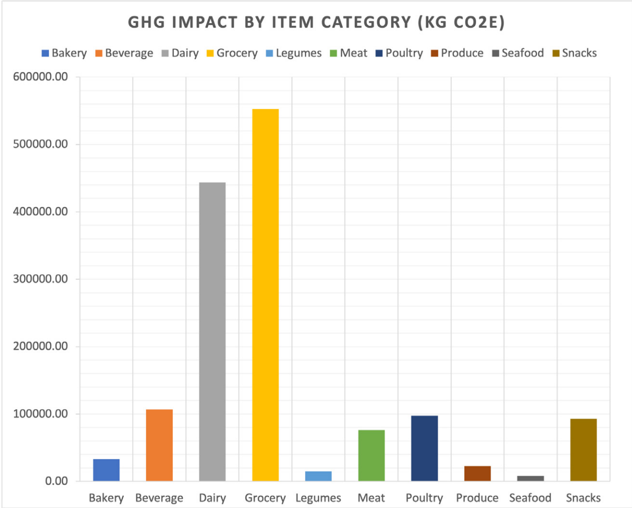
Table 2. Total mid-point environmental effects

Impact Category	Units	Result
Land Use	M2 (pasture & crops)	2’638,061.43
GHG	Kg. of CO2eq	1’448,320.44
Water pollution	g PO4 eq.	8’896,472.08
Air pollution	g SO2 eq.	12’393,615.99
Water Use	litres (withdrawn)	301’364,649.58

These values account for all upstream environmental impacts associated with the processing and transportation of commodities to retail stores, but exclude impacts from the post-production processing (e.g. converting sugar into a sugar-sweetened beverage), packaging and transportation of products to end consumer UBC (Clark et al. 2022). Transport impacts are drawn from global annual transport volumes by mode and allocated to different food products using US and EU freight surveys (Poore and Nemecek 2018). Downstream impacts (e.g. waste generation and transportation) are not within the scope of this report.

Figure 2 shows absolute impacts for each food category. Impact values of groceries and dairy are the highest across the majority of impact categories. Beverages have a high impact for water use and come in third place for the other environmental categories.





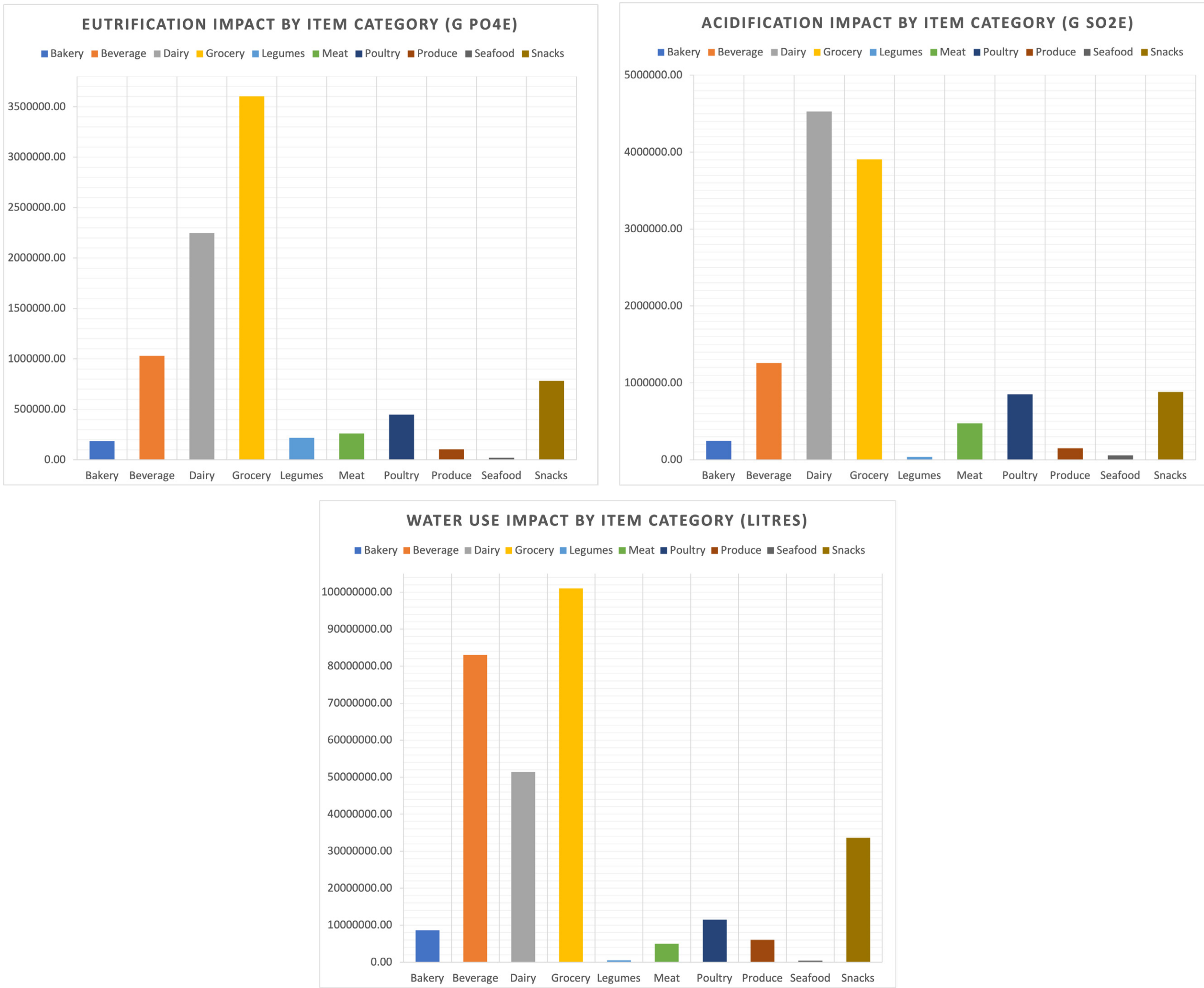


Figure 2. Absolute impact values on land use, GHG emissions, water and air pollution and water use of food procurement per food category.

End-point Impacts on Biodiversity

In total, UBC's food procurement has a biodiversity impact of 0.028 species loss year using data for 2022. This number, also called the biodiversity impact score (BIS), represents the cumulative proportion of local species (local to supply chain impacts) that would be lost as a result of food procurement's mid-point impacts on land, air and water. We want to acknowledge the limitation of using relative species loss as a proxy for impacts on biodiversity. This was the method used by Oxford; however, as they point out, biodiversity is a broad term describing the variation in biotic components at different scales (e.g. ecosystems, habitats, species, genes, functionality) so the use of BIS will work less effectively for situations in which species

loss is a biased proxy for biodiversity as a whole (Bull et al., 2022b)

Results for end-point (biodiversity) impacts based on contribution by mid-point impacts are shown in Figure 3. Agricultural land use has the largest impact on biodiversity loss with 64% of the BIS, which makes sense given the well documented impacts of agriculture on biodiversity (Taylor et al. 2022, Norris 2008). GHGs come in second with 14% of the BIS and air pollution third with 9%. The study by Taylor et al. (2022) found the same rankings for mid-point impact contributions to biodiversity loss.

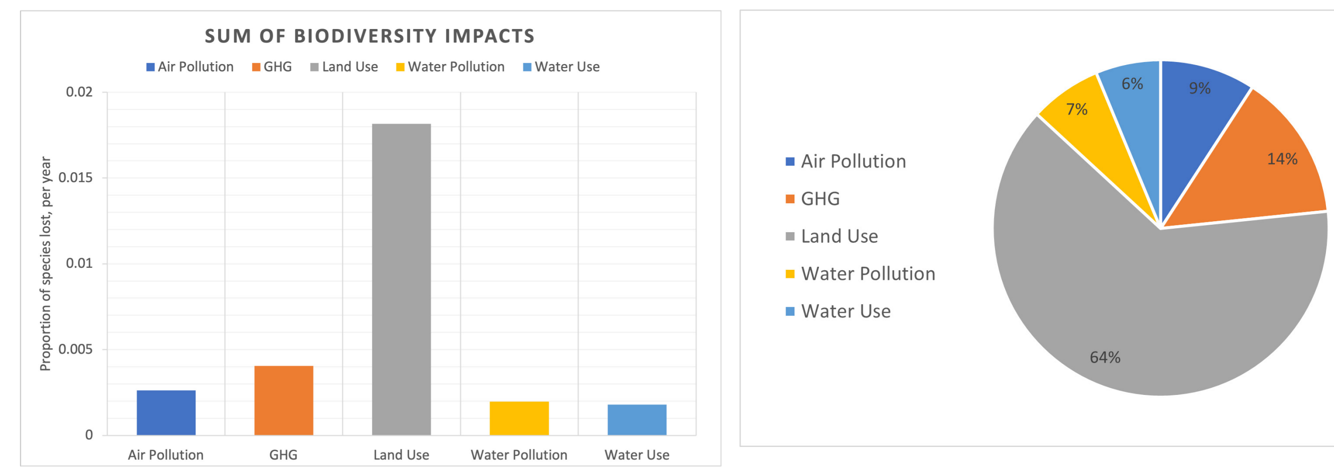


Figure 3. Embedded biodiversity impacts resulting from food procurement by UBCFS

Groceries contributed the most to biodiversity impacts (70%), mainly due to a greater mass of food procured in this category relative to other categories. Dairy, in second place, accounted for 13% of the BIS. (see Figure 4). Taylor et al. (2022) used the same reasoning (greater food consumption, rather than procurement in this case) to explain why sandwiches and wraps contributed the most to environmental impacts in their study.

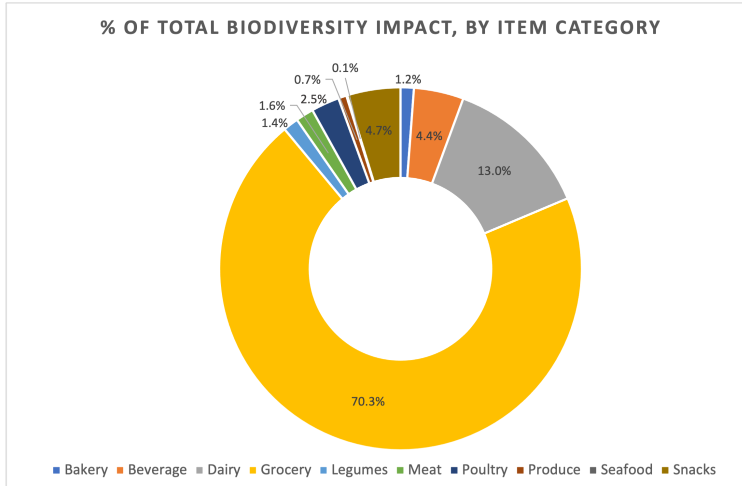


Figure 4. Biodiversity Impacts for food procured in UBC broken down by food product category.

GHGs

While land use had the greatest impact on biodiversity and our study is mainly focused on quantifying relative biodiversity impacts, we also want to highlight estimates of greenhouse gas emissions resulting from UBC's food procurement because we recognize synergies in tackling biodiversity and climate goals together (Taylor et al. 2022). GHG emissions indicate contributions to climate change, and quantifying food procurement related GHGs at UBC could result in tangible monitoring and reduction strategies for climate action. This report estimates the GHG emissions for food procurement by UBC food services at approximately 1,448 tonnes of CO_2 equivalent for the 2022 year. This number is slightly smaller than results from Oxford University for food consumption impacts under direct control in the 2019-2020 year period (1,673 tonnes of CO_2 eq.). As of December 2022, Oxford had a total enrollment of 26,497 students, while UBC Vancouver has a student population of 60,607. However, to compare the relevance of these figures, it would be necessary to know the number of people effectively using food services for each university, rather than the total student population.

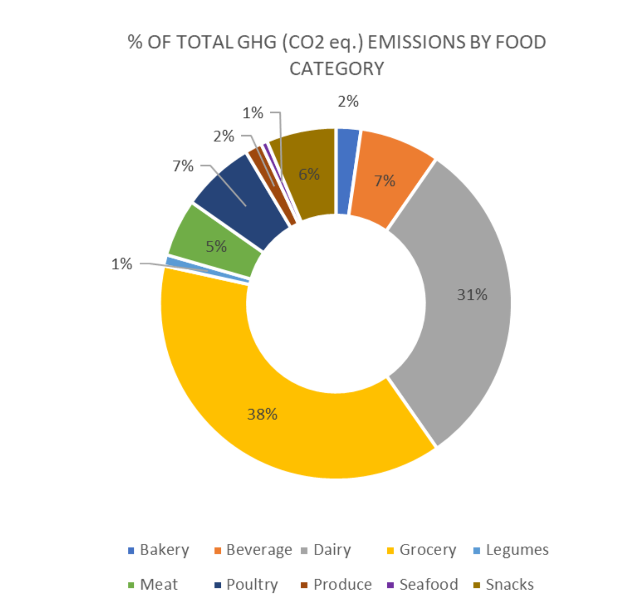


Figure 5. GHG emissions for food procured for University-owned cafeterias at UBC

Normalized data

We have seen that absolute values are strongly influenced by quantity or mass of food procured. This section displays the results for normalized data by weight, to analyze the mid impacts of food categories per kilogram.

Figure 6 shows the normalized mid-point impacts of food procurement. Results for normalized data show that meat, dairy and poultry have the highest per-kilogram impacts across all environmental categories, which aligns with existing evidence of the relatively higher contribution of animal products on environmental impacts compared to non-animal products. Seafood stands out for its high impact in GHG emissions and water and air contamination. Similarly, snacks accounted for the highest impact in water use of all food categories.

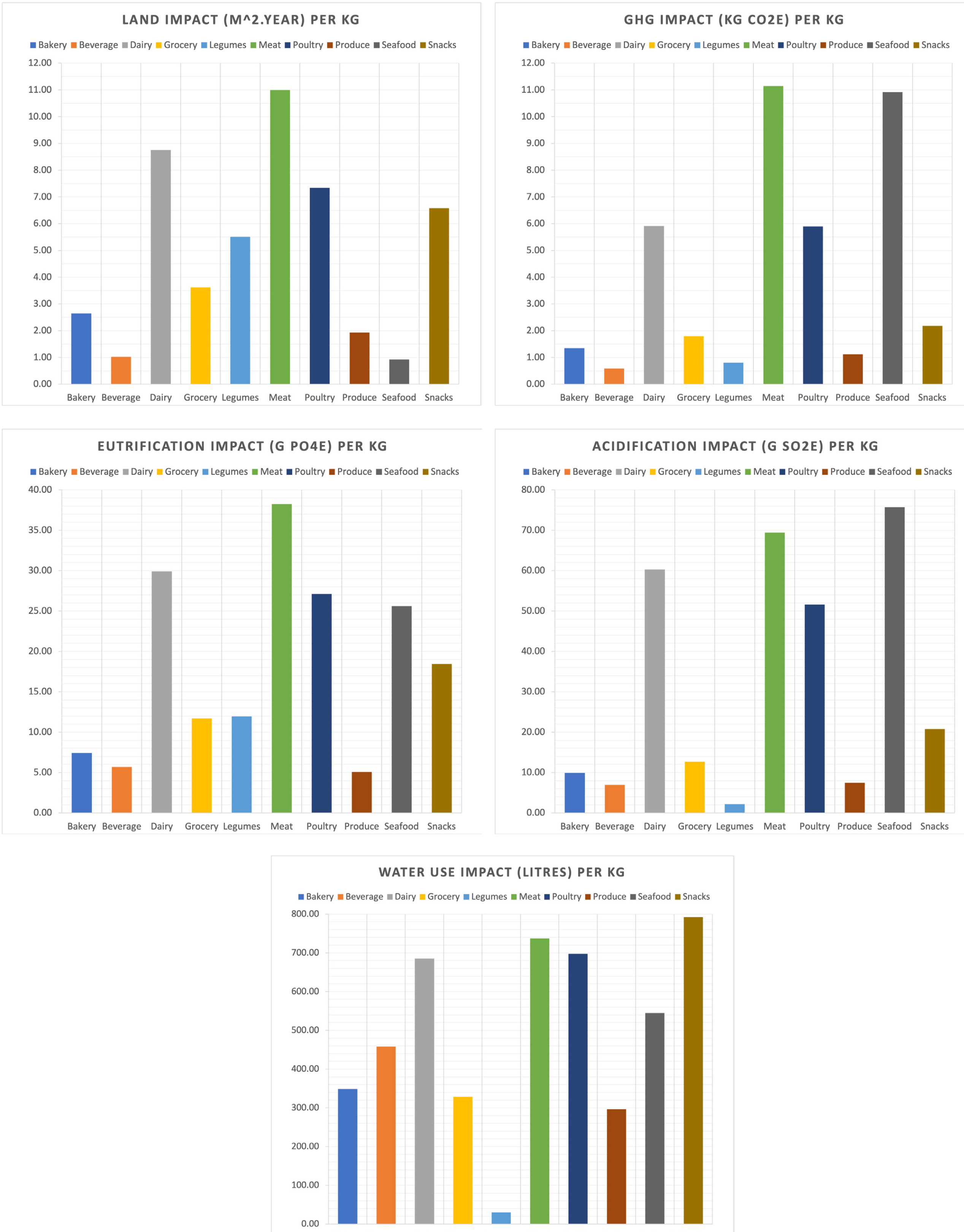


Figure 6. Normalized mid-point environmental impacts of food procurement by food category

Since meat, dairy, poultry and seafood have the highest per-kilogram environmental impacts, even small reductions in the procurement and consumption of these food categories shows potential to lower UBC's biodiversity footprint. However, UBC food procurement's actual impact on biodiversity may be illustrated best by our results by weight, rather than our normalized data. Since groceries and dairy contribute the most to biodiversity impacts, these categories should be a focus for reducing UBC's biodiversity footprint. Since both groceries and dairy categories are among the top procured products at UBC, investigating consumption versus waste patterns could help inform smart procurement changes especially where reducing procurement will reduce waste. Whereas procurement decisions may show the most success targeting groceries and dairy products, raising awareness amongst students about the disproportionately high impacts of meat, dairy, poultry and seafood is also important to ensure long-term consumption trends (which can influence procurement) move in the direction of sustainability.

The following section will discuss results and provide relevant recommendations.

Discussion

Despite some challenges, mostly regarding data availability, we were able to replicate the University of Oxford's study at the University of British Columbia using Oxford's tools and methods to characterize the biodiversity impact of UBC's food procurement operations. This study will aid in the development of impact-reduction strategies that UBC Food Services, Campus Planning and Sustainability teams can work together to implement. We did face several challenges when applying Oxford's framework to analyze food procurement data at UBC, including data organization and availability, developing a consistent and accurate matching scheme, impact discrepancies between products, and efficient communication with project partners. In order to help future research teams effectively employ Oxford's framework to their own institutional assessments, we detail these challenges and provide insights on how we navigated them. In the next section we also provide recommendations for institutions to increase the usability of food procurement data and suggest ways they can use the results of biodiversity impact assessments.

UBC Data Availability

While the study at Oxford examined sales data (products purchased by students) as a proxy for consumption, UBC Food Services (UBCFS) provided us with only procurement data (all of the food brought in by UBC). Procurement is considered under the direct control of the University, whereas consumption is only indirectly influenced by UBC Food Services. Our analysis of procurement impacts illuminated areas for improvement, but focusing on procurement changes shifts attention away from the impact reduction potential of students making sustainable consumption choices.

Oxford found that the largest biodiversity losses were indirect results of resource use and waste in external supply chains outside their direct control. Thus, activities within the indirect sphere of UBC's influence should also be targeted. While consumption cannot be directly controlled by UBC, these decisions can be influenced through programming and awareness-building events. In other words, UBC food procurement decisions by themselves may improve the sustainability of options available to students, but by themselves will not change student consumption patterns, without active encouragement and dialogue around sustainable consumption choices. Pertinent to this discussion on the efficacy of procurement changes is the concept of "leakage", where the displacement of activities elsewhere results in an unexpected loss of environmental benefits from the original project. If UBC modified its food procurement to reduce biodiversity impacts without simultaneously engaging with students about sustainable consumption choices, there is a risk that students will move their food purchasing to a less-sustainable outlet outside of UBCFS. Currently, UBCFS has efforts to impact demand for "Climate-Friendly Food" through UBC's Climate Action Plan, which marks a step in the right direction (UBC Campus and Community Planning, 2022). Food procurement changes can complement these consumption and education-focused actions.

Furthermore, with only food-related data, we only illustrate one aspect of UBC's supply chain and its impacts on biodiversity. To fully characterize UBC's biodiversity footprint, further assessments would need to be conducted on other institutional activities such as transport services, construction, travel, use of supplies in research.

Food procurement data provided by UBCFS may not be fully representative of food procurement on campus. Between the dining halls, cafeterias, businesses and retailers supplied by UBCFS and another provider, AMS Food Services, UBCFS provides around 80% of the food. However, many other businesses outside of these two providers exist, which reduces the overall percentage of food provided by UBCFS for the entire campus. Our data reflect the food procurement impacts of the largest food provider on campus, and may indicate similar trends across vendors, but does not fully encapsulate food procurement impacts on the UBC Vancouver campus. Additionally, we only analyzed one year of data, and the most recent year of full data available (January to December 2022) may not reflect pre-pandemic food procurement patterns since there may still be fewer students on campus and some food service disruptions from the past several years may not have returned to "normal". That being said, data from 2022 may be representative of food procurement patterns moving into a post-pandemic/pandemic-recovery future.

Furthermore, procurement data does not necessarily reflect consumption on campus. In order to reveal food consumption patterns, we need data that accounts for the downstream impacts of food procurement what happens to the food after it is purchased by UBCFS? How much food and which foods are actually being consumed? How much is being wasted? While procurement data tells us what foods UBC is buying, sales data could indicate what students themselves are actually choosing to eat and potentially reveal trends about demand and waste. Although we had access to some waste data collected independently, this could be integrated into procurement data for analysis, since procuring appropriate quantities of products could reduce waste and biodiversity impacts without affecting current consumption patterns.

The data itself contained inconsistencies in units and availability across months, making interpretation and matching challenging, especially in the absence of metadata or a key for unit and product name abbreviations. For instance, depending on the supplier, units were sometimes expressed as "Z" or "OZ" for "ounces", and both "KGA" and "KG" stood for "kilograms". Some products were expressed in "UN" (units) rather than in volume or mass. For some months, "net weight" was available for products, but in other months only "weight" were available. Weight included packaging, while net weight pertained to the mass of the actual product. Where we had to use the gross weight, our mass estimates of each product and the ensuing impact calculation may be conservative (higher than actual). However, our impact calculations are only for food products and do not factor in the environmental impacts of packaging of food purchased by UBCFS—a limitation of Oxford's framework. In the absence of metadata from UBCFS, we assumed net weight and weight were in Kg after testing out many examples which showed that other units were ultimately converted to Kg in these columns.

Abbreviations for column and product names were also difficult to decode, and no keys were available to interpret them. We had to decipher and guess at what columns such as "pack" versus "quantity" and "size meant. Many abbreviations were used for product names (ex: "CHICKEN DCD 1/2IN 60WHT/40DK CKD FZN") and in some cases where the product name was unclear, it was hard to find an accurate match for the UBC product in the Open Food Facts database. These inconsistencies and the lack of metadata point to the need for organized and consistent data entry, which can be difficult to coordinate across different suppliers with varying standards. Thus, a key or metadata compiled by the university could help future research teams understand inconsistencies in the data.

The data were organized into rather arbitrary and non-intuitive categories, and many products assigned a particular category would have fit better in another. This is especially true for products in the "Grocery" and "Frozen" categories which included products which could have fit under "Meat", "Produce" and "Beverages", to name a few examples. The organization of the data were not conducive to our analysis, because we wanted to analyze the environmental impacts of different, intuitive food categories in order to identify types of foods with high versus low impacts and make recommendations for more sustainable procurement decisions. We ended up re-coding the data into more intuitive groups, but used the "Grocery" category as a catch-all label for products that did not have their own category. For more nuanced analysis of food categories in the future, the "Grocery" category should be expanded into more granular groups, including "Grains", for example.

Open Food Facts (OFF) Data Availability and Matching

To assess the environmental footprint of food procurement at UBC, we matched individual products purchased by UBCFS with products contained in a convenient spreadsheet compiled by the Oxford team. This spreadsheet described the land, eutrophication, acidification, water use and GHG impact of food supply chains (production and transporation) for around 20,000 food products using methods from Clark et al. (2022) and Poore and Nemecek (2018) to calculate estimates of environmental impacts of individual and composite food items found on the Open Food Facts database.

Not all food products purchased by UBCFS were included in this Open Food Facts Impacts (OFF Impacts) spreadsheet, leading to imperfect matches (206 products/1317 total products = ~ 15.6%) and some impossible matches (20/1317 = ~ 1.5%). We left out of the analysis 20 "impossible match" products, which could lead to a slight underestimation of total impacts, though our conservative, precautionary principle approach (discussed below) likely pushes our results in the opposite direction. We screened "imperfect" matches and identified as close of a match as possible. However, we acknowledge that there may be no such thing as a "perfect" match. Although Oxford's calculations using Clark et al. and Poore and Nemecek account for global averages of environmental impacts for commodities, local nuance is missing from the OFF Impacts spreadsheet, since the exact apples bought by UBCFS may not match perfectly the apples included in the spreadsheet depending on the actual production location and conditions.

Additionally, the environmental footprint of similar products may vary significantly. We noticed that across all environmental categories, however water usage (in liters) in particular varied considerably between iterations of the same product. This is likely a result of the high variation in environmental impacts among producers as identified by Poore and Nemecek (2018) or due to differences in ingredients used for the same product from different retailers. For example, when searching for "veggie burgers", two veggie burgers came up with similar values for all environmental impacts except water use. For one, water use was 8.24 liters/gram and for the other, water use was 40 liters/gram. Unless the exact veggie burger purchased by UBCFS was assessed by Oxford, we are likely to experience some deviations in our impact calculations. In other cases, such as for the search term "cornflour", one of several match options had exceptionally high impact values. Given our selection bias towards high-impact matches to err on the side of caution, such irregularities in the food database inevitably affect our findings and potentially skew it upwards.

Another concern was that according to the OFF database certain products like bottled water, bamboo shoots and salt had zero mid-point impacts across the board. This rating of zero impact may be because the impacts of production, especially in regards to harvesting or extracting wild products, are neglected or omitted. For instance, the packaging, treatment, and transportation of bottled water clearly do have an environmental impact. If nothing else, the extraction of water as a natural resource is a direct form of water use. These "zero impact" items may lead to a dangerous and false sense of sustainability.

One matching issue we faced was when the "closest match" involved pairing vegetarian or vegan products with a non-vegan analog (or vice versa). We avoided this as much as possible, since the environmental impacts of animal products can differ significantly from animal-free products. While exact matches with UBCFS products are unlikely, our matching scheme including “imperfect” matches (getting as close as possible and choosing the version with the highest impact when duplicates existed), is likely robust enough to represent an estimate of environmental impacts.

Since we were using the food impacts database developed by Oxford, we were limited to products included in this database and in some cases essentially matched UBCFS products with their UK counterparts. Using Oxford’s open food facts to calculate impacts for UBC may be sufficiently accurate for many, but not all products. For instance, the closest match to “mussels” was “Scottish mussels”, which may differ considerably in impact, since seafood impacts strongly depend on location and production method (harvesting vs. aquaculture)--information that we are lacking for our data. Furthermore, some Canadian-specific foods like poutine, Coffee Crisp candy bars and Nanaimo bars could not be found in the spreadsheet and had to be substituted by closest matches or omitted with other “impossible” matches.

Though we did our best to match every single product, there were some that had no existing analog. In these cases, the next best solution we suggest would be to apply the methods from Clark et al. (2022) to split composite items into ingredients (if it was a composite item) and subsequentally use Poore and Nemecek (2018) global impact averages to calculate GHGs, water use and water and air contamination impacts for each commodity. Open Food Facts Canada is another resource to find supply chain impacts. However, it only contains impact information on GHG emissions of food production. We were not able to calculate the impacts of each of our “imperfect” and “impossible” matches due to time constraints. Calculations for specific products within Canada (or the region of study) may be the most accurate way to assess environmental impacts, but enough time should be given to this task. However, the database provided by Oxford contains global averages, so it is satisfactory as a starting point for future teams replicating this study for other sectors.

Lastly, regional differences in terminology resulted in some difficulty in searching for products. For example, what Canadians call “fries”, “chips”, “shrimp”, “cilantro”, “Swiss cheese”, “Provolone”, “lima beans”, and “heavy/whipping cream” had to be translated into UK synonyms: “chips”, “crisps”, “prawns”, “coriander”, “Emmental”, “Cheddar”, “butter beans”, and “double cream” respectively.

Communication with UBCFS and The University of Oxford

One limitation we faced in regards to communication is that we were not we were not able to liaise with UBCFS directly, which affected our timeline. In an ideal scenario, we would have started the conversation with UBCFS early and cleared up questions, especially regarding the raw data (consistency and clarity of units and quantities).

Recommendations for UBC and Future Universities Under Analysis

UBC has already taken leadership in reducing its GHG impacts through its 2030 Climate Action Plan (CAP) and update of the Zero Waste Action Plan, where food procurement plays a key role. UBC campus food systems is the second highest category in extended impact emissions accounting for just over 21% of UBC’s overall GHG emissions. In this order, UBC has set up a target of achieving a 50% GHG emission reduction by 2030 and has defined a series of short and mid term actions to contribute to this goal (Campus and Community Planning, 2021). Based on our findings, we provide a list of recommendations that build from existing work and pay particular attention to food procurement, so as to leverage existing actions in the CAP (Table 3).

Table 3. UBC CAP 2030 Food Systems short term actions and how our recommendations work towards these actions

CAP 2030 Food Systems short-term actions – applicable to our project	Our recommendations
Develop campus-wide Climate-Friendly Food System (CFFS) definition, mandatory CFFS labelling, and a toolkit to increase sustainable dietary choices and habits.	• Implement strategies to reduce procurement of meat, poultry and dairy food products. These can address the change of cultural norms of food consumption through the widespread information of GHG and Biodiversity impacts of food categories in workshops or training programs with UBC residents, faculty and students. Define standards of biodiversity impact scores, carbon ratings and apply these to food labelling systems at dining halls.

CAP 2030 Food Systems short-term actions – applicable to our project	Our recommendations
Develop and implement mandatory campus-wide Climate-Friendly Food System Procurement Guidelines applicable to all food providers.	• Enhance procurement procedures guidelines by further breaking down "groceries" into finer food categories. This can be required from UBCFS to each of its food vendors. Groceries was often a catch all category for food products that did not fall within other food groups, and it included frozen products, canned food, pasta, pantry items, plant based substitutes etc. This is of great importance, because as we found, groceries had the highest absolute GHG and biodiversity impacts of all food categories. Having a more granular food scheme for groceries will help in directing efforts to specific food items that have high impacts within this category.
Amend the UBC Supplier Code of Conduct to reflect UBC's climate commitments.	• Review procurement RFP language and conditions, to encourage and favor retailers with climate friendly food practices extending upstream the food production process. For example, favor suppliers that actively engage with low impact agriculture practices, track their environmental impacts in the supply chain, and limit packaging or provide recyclabe packaging options. • Include a standardized data reporting scheme in RFP documentation that standardizes food abbreviations, quantity units, keeps track of food net weight and calculates packaging weight in a separate column. Including these guidelines will increase data transparency and clarity for easier data analysis and reporting. • Require vendors to provide information about ingredients for each food item to quantify environmental impacts more accurately in the future. Having information about ingredients enable researchers to properly use Clark et. al (2022) methods to match to the specific commodities used to create composite food items.

CAP 2030 Food Systems short-term actions – applicable to our project	Our recommendations
Leverage and expand established interdisciplinary research initiatives, student and faculty-led research to advance climate-friendly food systems, spanning climate mitigation and adaptation.	• Replicate this study to calculate food procurement impacts for other years and keep track of environmental and biodiversity impacts. • Use University of Oxford's framework to further investigate the environmental and biodiversity benefits of procuring local and organic products, using the results of this report as a baseline for comparison. • Use University of Oxford's framework to analyze food sales under direct and indirect control of UBC. Examples of sales data under direct control include food sold at catering events, UBC cafeterias and dining halls. Examples of indirect control include food sold at non-UBC owned food outlets. • Compare food procurement and food sales data to derive potential food waste data. Compare this information with official waste tracking systems at UBC. • Implement a communication protocol with all partners involved in food services at UBC to streamline food services impact calculations as a regular year to year process.

Conclusion

Human-driven global environmental issues, such as climate change and biodiversity loss, are urgent and severe. Large organizations, such as universities have a responsibility to evaluate and minimize the impact of their activities. In this project, we followed the methodology used by Bull et al. (2022a) and Taylor et al. (2023) to evaluate the University of Oxford's biodiversity footprint. In doing so, we found the methodology replicable for analysis of UBC's food procurement activities directly under the university's control. Some challenges that arose included regional differences in food availability and consumption, data availability, lack of transparency about food item ingredients, and consistent communication with project collaborators. Overall, undertaking a biodiversity analysis using Oxford's framework may be worthwhile for other aspects of the UBC's food-related activities, as well as other domains of activity such as business-related travel or research laboratory operations.

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