University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Enhancing Biodiversity and Resilience

Informing a Climate-Friendly Food System Procurement Strategy at UBC

Prepared by: Sarah Clarke, Liana Salviejo, Julia Taylor, Vicky Kim, Luke Schleindl, and Ashley Bell

Prepared for: Student Housing & Community Services, Campus + Community Planning, UBC Botanical Garden, Sociological Ecological Economic Development Studies (SEEDS) Sustainability Program

Course Code: LFS 450

University of British Columbia

Date: Apr. 16, 2022

Disclaimer: "UBC SEEDS Sustainability Program provides students with the opportunity to share the findings of their studies, as well as their opinions, conclusions and recommendations with the UBC community. The reader should bear in mind that this is a student research project and is not an official document of UBC. Furthermore,

readers should bear in mind that these reports may not reflect the current status of activities at UBC. We urge you to contact the research persons mentioned in a report or the SEEDS Sustainability Program representative about the current status of the subject matter of a report".

EXECUTIVE SUMMARY

When considering and reflecting on our food systems, sustainability is increasingly becoming an issue of focus and action. Within the concept of sustainability, biodiversity is a key issue impacted by many components of food systems. From an ecological and agricultural perspective, biodiversity is important for sustainability as it contributes to ecosystem health and function, ecosystem resilience, and climate change mitigation (Campbell et al., 2008). Through these functions, biodiversity also contributes to food system productivity and resilience (Isbell et al., 2015). As we experience the impacts of climate change such as increased temperature and extreme weather events, biodiversity is becoming increasingly important to enable our food systems to persevere (Isbell et al., 2015).

Currently, many aspects of our production systems are contributing to the loss of biodiversity. Most conventional agricultural practices and land-uses are drivers of global biodiversity loss, and contribute to approximately one-third of greenhouse gas emissions (Dudley & Alexander, 2017; Crippa et al., 2021). Evidently, continuation of the practices will only contribute to the agricultural challenges associated with global warming.

In the context of the University of British Columbia's (UBC's) food system, biodiversity has been identified as an important food systems issue, as described in the Climate Action Plan (CAP) 2030. From this, the need for biodiversity-specific procurement information was recognized. Contributing to a campus wide Climate-Friendly Food System Procurement Strategy, this project aims to inform development focusing on food system biodiversity and supply-chain resilience. This goal is achieved through several actions. Primary data was collected following Community Based Action Research (CBAR) methodology, incorporating critical stakeholders (Burns et al., 2011). Stakeholders include UBC food procurement representatives, UBC researchers, and student organizations. Secondary data was also collected through a review of available literature and an environmental scan of institutions and municipalities.

Several issues are investigated by the primary data collection: 1. Ideal biodiverse food procurement, 2. Gaps and barriers with biodiverse food procurement, and 3. Demands to achieve biodiverse food procurement. Primary data results identified several sub-themes within each concept as follows: 1. Local and seasonal foods, best-practice producers, and indicators and measurement, biodiversity and resilience definition, minimized food waste, and accessible pricing; 2. Perceived procurement costs, perceived student costs, consumers demands, and education; 3. Framework for a circular food system, and creation of a charter.

Results from the secondary research explore a relatively broad range of topics relating to findings from the primary data collection. The importance of biodiversity, associated farm practices, foods promoting biodiversity, and producers locality are described. Certifications and the cost of biodiverse foods are also discussed.

From our primary and secondary results, short-term, mid-term, and long-term recommendations are synthesized and described. Areas of opportunity for future research are also provided and discussed.

Short and mid-term recommendations:

1. Look for eco-labels
2. Perennial crops over annuals
3. Diversify foods and varieties
4. Diversify suppliers
5. Buy directly from farmers
6. Buy seasonally

Long-term recommendations:

1. Support ecological farms
2. Create a Biodiversity Action Charter
3. Create a permanent paid position

Future research:

1. Increased cost of procuring biodiverse foods
2. Connections between locality, biodiversity, and other sustainability priorities

CONTENTS

LIST OF ABBREVIATIONS

CAP 2030: Climate Action Plan 2030

CBAR: Community-Based Action Research

CFFS: Climate-Friendly Food System

UBC: University of British Columbia

UBC C+CP: UBC Campus + Community Planning

UBC FSP: UBC Food System Project

1. INTRODUCTION

1.1 RESEARCH TOPIC

Biodiversity can be defined in the technical sense as the "variety of life found in a place on Earth" (Pimm, 2021). In the context of our report and this project, this is seen in food as the variety of crops, plants, and animals that are used to produce it, which we will refer to as "biodiverse foods". Farms must use certain practices in order to achieve this, such as diverse crop rotations and limited chemical use. In terms of institutional food procurement, differences in how various types of stakeholders perceive and value biodiversity plays a factor in the challenges of defining these concepts, goals, strategies, and indicators. Furthermore, there is a current lack of exemplary food procurement strategies elsewhere that specifically account for biodiversity, demonstrating that this issue is the latest result of a recent broadening in our horizons of sustainable food systems in the face of climate change, signifying the potential for knowledge gaps to be filled and actions to be taken. This poses the opportunity for greater collaboration between researchers, practitioners, farmers, and food procurement staff at UBC to build a climate-resilient food system for the local community and beyond.

1.1 RESEARCH RELEVANCE

Within current biological and agricultural research, there is sound evidence that advocates for the protection of biodiversity as a means of enhancing ecosystem resilience and benefiting environmental health. As a general point, complex biodiversity is inherently important to climate change mitigation as diverse ecosystems work intrinsically to sequester carbon from the atmosphere and store the gas in soil and biota (Campbell et al., 2008). In turn, this reduces the amount of carbon dioxide within the atmosphere which would otherwise contribute to anthropogenic global warming. Not only this, but maintaining biodiversity is critical to resilience within our food systems. Ecosystem complexity is proven to lower the vulnerability of flora communities to extreme weather events and temperature variability (Isbell et al., 2015). Additionally, Isbell found that ecosystem diversity increases the productivity of natural systems. Thus, in the face of a changing climate, reducing biodiversity within food systems will likely decrease productivity (Isbell et al., 2015). Due to projections of the global population expanding to 9.2 billion people by 2050, which will put further pressure on global food systems, there is an increased need to feed growing populations while still protecting the natural world (FAO,

2009). Conserving biodiversity within the global food system is therefore crucial to the productivity and resilience of ecosystems in the years to come.

The current global food system relies heavily on production practices that can be harmful to both human and ecological health. Modern agricultural practices and land cultivation are leading drivers of biodiversity loss (Dudley & Alexander, 2017) and food systems are a major contributor of greenhouse gas (GHG) emissions worldwide, making up approximately one-third of it (Crippa et al., 2021). Ecosystem services are the benefits received by humans through proper ecosystem functioning, such as water, food, cultural values, healthy soils, and nutrient cycling (Wallace, 2007). These services are being put at risk by the current crises of climate change and declining biodiversity levels. Evidently, biodiversity conservation benefits natural systems as well as human health. Seeing as food systems are responsible for the destruction of many complex natural systems, shifts in production and distribution need to occur in an effort to protect and regenerate biodiversity for climate-resilient food systems and overall human well-being.

1.3 PROJECT CONTEXT

Emerging plans for campus sustainability at UBC have recognized the need for a better focus on biodiversity and climate resilience. These include the Climate Action Plan (CAP) 2030, AMS Sustainability Action Plan, and Campus Vision 2050, each of which outline bold targets that cannot be achieved without a holistic view that incorporates biodiversity. According to the UBC Board of Governors, the University's food system as a whole accounts for 29,000 tonnes of CO_2 emissions each year (CAP 2030, 2021). One such target within the CAP 2030 is to lower GHG emissions from campus food systems by 50%, with short-term actions including the improvement of procurement guidelines for food providers. The Climate-Friendly Food System (CFFS) is part of the UBC Food System Project (UBC FSP) and specifically incorporates the need for biodiversity-friendly foods in its attribute of promoting resilient and regenerative food systems (Richer, 2021). Collectively, these plans must lend greater attention to biodiversity, signifying where this project's goals came to be a need.

Past research related to CFFS at UBC has looked into food procurement strategies present within peer institutions and their use of tools such as eco-labels and certification standards for food purchases (Stone et al., 2021). Recommendations for the direction of future research include greater consultation among campus

stakeholders and various groups such as UBC Food Services and student organizations involved in sustainability initiatives (Nanayakkara, 2021). Menu transparency and an increase in plant-based food options were also emphasized in several research reports (Liu et al., 2019). From a smaller to a larger scale of recommendations, Stone et al. (2021) outlined the need for purchasing guidelines and certifications, substitutions of certain foods, and a more conscious effort to procure food from farms employing sustainable practices (e.g., polycultures). And lastly, increased education that can influence a consumer-based shift in favor of climate-friendly foods is needed in the long run.

1.4 PROJECT PURPOSE, GOALS AND OBJECTIVES

RESEARCH PURPOSE:

To promote biodiversity and climate resilience by proposing indicators and strategies that will inform UBC's development of a Climate-Friendly Food System (CFFS).

RESEARCH GOALS:

To assess and identify opportunities that promote biodiversity conservation and resilience in campus food procurement and across the supply chain.

RESEARCH OBJECTIVES:

- Conduct an environmental scan to identify promising practices of exemplary food procurement methods in place within other cities and post-secondary institutions that specifically target biodiversity and climate resilience to inform campus food operations and policies.
- Analyze UBC's emerging plans, practices, and research for food systems and climate action to determine the most impactful areas for advancing climate resilience and biodiversity.
- Establish a set of goals, actions, and indicators that align with the identified practices for fostering biodiversity and climate resilience to advance a CFFS Strategy at UBC.

2. METHODOLOGY AND METHODS

2.1 RESEARCH METHODOLOGY

For this Community Based Action Research (CBAR) project, which incorporated critical stakeholders throughout the entire research processes (Burns et al., 2011), it was critical that our objectives pertained to community experts and overall engagement. The 'Look' phase of the Look-Think-Act (LTA) phases (Stringer, 2004) included a literature review and consultation with project clients to understand past research that has been done on related topics in the UBC context and to identify the communities we will engage with. Ethical selection of stakeholders for data collection is a critical component of CBAR methods (Burns et al., 2011), and was ensured by providing opportunities for all stakeholders to participate in the individual interview or focus group for primary data collection if desired. We also conducted a thorough literature review to minimize the exclusion of those this research would be affecting. The project group ensured ethical stakeholder engagement prior to the primary data collection by providing project information and asking for written consent for how the collected data could be used, and by facilitating a professional space for stakeholders and respecting their boundaries. A literature review was conducted again following the interviews to further identify supporting evidence. The 'Think' phase bridged findings from both the primary and secondary data to provide complete pictures of both the current challenges and best practices for supporting biodiversity and climate resilience in UBC's food procurement strategies. This knowledge will be translated to final project deliverables in the 'Act' stage.

2.2 RESEARCH METHODS

2.2.1 SECONDARY DATA COLLECTION RESEARCH METHODS

For the secondary data collection, literature reviews and environmental scans were performed before and after our primary data collection. The literature review and environmental scan that took place prior to the focus group and individual interviews helped inform the participant selection process, as well as aided the creation of interview and focus group questions. Past CFFS-related project deliverables, CAP 2030, the UBC Food website, the Climate-Friendly Food Label, and other sources provided context on other cities and peer institutions' experiences with supporting biodiversity and climate resilience in their food supply chain. The second

literature review took place following the primary data collection to find sources that support themes identified by the stakeholders, and to best inform the development of actions and indicators to improve the trajectory of the CFFS. Papers and scholarly articles were searched using the "Web of Science" to find topics such as: certifications that promote biodiversity, the cost of switching to a biodiverse diet, and articles that outline the importance of biodiversity in food procurement. Other searches included farm practices that promote biodiversity but might not be included in certifications. Additionally, websites of the certifications were searched to see their criteria and promising practices surrounding biodiversity. These include: Regenerative agriculture, Canada Organic certified, Forest Stewardship Council (FSC) certified, Smithsonian Bird Friendly, and Salmon-Safe.

Literature reviews were also done independently by members of the project group on varying topics, and relevant information acquired through those processes are included in the results section of this report.

2.2.2 PRIMARY DATA COLLECTION RESEARCH METHODS

The total sample for primary data collection included focus group participants who were all from the CFFS Action Team (n=9), as well as individual interview participants (n=5). From the CFFS Action Team, there were representatives from UBC Food Services (n=3), the UBC SEEDS Sustainability Program (n=3), the UBC Botanical Garden (n=1), UBC C+CP (n=1), and UBC Wellbeing (n=1). The campus departments and organizations in which the representatives in the focus group were from work within or help to inform UBC's food procurement and supply chains. Individual interviews were conducted with researchers within the fields of agriculture, biodiversity, and resilience (n=3), as well as student representatives from UBC Sprouts (n=1)—a student-led food organization that operates separately from UBC Food Services, but provides food for those on campus—and the UBC Climate Hub (n=1).

The intent of the focus group was to better understand the goals in place or the actions that have been taken to prioritize biodiversity and resilience in their involvements within the campus food procurement strategies, as well as other insights, expertise, and desires that they may wish to voice in consideration of this project. Objectives of the individual interviews included interacting with campus individuals and groups, not involved with UBC Food Services, who have insights on biodiversity and climate resilience within food production and procurement on campus and beyond, as well as to gather knowledge and guidance on best practices that will

benefit the community as a whole.

For both focus groups and individual interviews, representative sampling—a method of using a subset of a group to accurately reflect the characteristics of a larger group—was used to provide opportunities for participants to speak on behalf of the group they are associated with. As some representatives are involved in work that is more relevant to the project objectives than others from the same group, representative sampling highlighted the voices of those that speak to specifics of biodiversity, resilience, or food procurement strategies with the most detail and relevance from their group. Moreover, it was an efficient way to identify resonating themes within a particular group given the timeline of the project without having to consult all members of the group.

A full description of the project, final deliverables, and expectations were communicated to all participants through an email before the focus group or individual interviews. All focus group participants provided consent for the note-taking and analysis of the information that were provided during the focus group session, as well as the use of data that they provided during the focus group in final project deliverables with a partially anonymous reference (e.g., Representative from [insert department/organization name]). All individual interview participants provided consent for the recording, transcribing, and analysis of the information that were provided during the interviews, as well as use of data that they provided during the interviews in final project deliverables with a partially anonymous reference.

The focus group, conducted on Zoom, was held with two other project groups who were also conducting research on various aspects of a CFFS procurement at UBC. To provide chances for all project groups to interact with the attendees, focus group participants were divided into three breakout groups and had the opportunity to interact with each project group for 25 minutes. Participants were given the opportunity to provide written responses for prepared questions on a Google Jamboard, oriented in a way where participants within the same breakout group could see each others' responses but could not view responses from other breakout room participants. They were also provided the chance to expand on their written responses through verbal communication with the breakout group. Due to the time constraint of some breakout groups, some participants did not have the opportunity to respond to all questions. Though the focus group was not recorded, notes were

taken on the written and verbal responses and were used in analysis. All questions asked in the focus group can be found in Appendix A.

Individual interviews were also conducted on Zoom for 30 minutes to an hour, except in one instance where the participant provided written responses via email instead. For Zoom interviews, each interviewee was asked structured questions, asked to all interviewees, as well as semi-structured questions that were personalized to their expertise and role on campus. Furthermore, opportunities for follow-up questions were provided for the interviewers to allow flexibility for discussion among participants, and to provide room for additional knowledge to be shared aside from our prepared questions. All Zoom interviews were recorded and transcribed in preparation for analysis. All questions asked in the individual interviews can be found in Appendix A.

As participants were asked or chose to answer the questions that were most suited for their experiences, knowledge, and expertise, there is variance in the sample sizes for each question. Responses from the focus group and individual interviews of most relevance were analyzed by thematic analysis, following the methodology of Damayanthi (2019). For questions that were asked to more than one participant, final results were combined and the total sample size that mentioned each sub-theme, as well as the total number of mentions of each theme, were calculated. An example of thematic analysis that was done for this project can be found in Tables B-1 and B-2 (Appendix B).

2.3 METHODS OF ADMINISTRATION

The participants were selected through the help of our clients and by reaching out to known stakeholders within the UBC food system. The focus group was organized through a representative from the CFFS Action Team, who helped our project group to further our reach of networks to invite those from various UBC departments and organizations at one time. Participants for the individual interview were selected based on our initial environmental scan, when they were identified as members of the UBC community with extensive knowledge, experiences, and insight on biodiversity and resilience in food production, food procurement for consumers on campus, and student and community perspectives.

Primary data collection took place from March 11th to 28th, 2022; further information on the focus groups and individual interviews conducted can be found in Table C-1 (Appendix C). Focus groups and individual

interviews were preferred over surveys, as the project group desired an opportunity to ask tailored and personalized questions to various members of the UBC community, based on the participants' roles, experiences, and expertise. Secondary data collection took place from January to April 2022.

3. RESULTS

3.1 PRIMARY DATA RESEARCH FINDING

3.1.1 IDEAL BIODIVERSE FOOD PROCUREMENT

Department- and organization-specific

8 representatives from the CFFS Action Team were asked what ideal biodiverse food procurement would look like in their departments and organizations. Five key themes were identified from their responses, as shown in Table D-1 (Appendix D): i) emphasis on procuring specific foods (11 mentions); ii) consumer accessibility (2 mentions); iii) development of a biodiverse procurement strategy (2 mentions); iv) environmental conservation/restoration (1 mention); and v) farm-to-table connections (1 mention).

Notable sub-themes identified specific to procurement include **local foods**, mentioned by 37.5% of participants (n=3; 2 representatives from UBC Food Services and 1 from UBC C+CP); **seasonal foods**, mentioned by 25% of participants (n=2; all representatives from UBC Food Services); and iii) **foods from producers audited for best practices**, mentioned by 25% of participants (n=2; 1 representative from UBC Food Services and the UBC SEEDS Sustainability Program, respectively). For the development of a biodiverse food procurement strategy, the importance of having **indicators and measurements** in place was mentioned by 25% of participants (n=2; 1 representative from UBC Food Services and the UBC SEEDS Sustainability Program, respectively). Information on all sub-themes identified can be found in Table D-1 (Appendix D).

UBC-specific/General

A total of 12 participants—including representatives from the CFFS Action Team, UBC Sprouts, and the UBC Climate Hub, as well as researchers—were asked what ideal biodiverse food procurement would look like at UBC, as well as at a more general standpoint. Seven key themes were identified from their responses, as shown in Table D-2 (Appendix D): i) development of a biodiverse procurement strategy (11 mentions); ii) procurement and

commercialization of specific foods (10 mentions); iii) consideration of sustainable/resilient agricultural producers (6 mentions); iv) waste and GHG emission reduction (5 mentions); v) consumer accessibility (4 mentions); vi) financial support for consumers (1 mention); and vii) financial support for procurers (1 mention).

For the development of a biodiverse procurement strategy, the importance of an **improved and clear definition of biodiverse and resilient food procurement** was emphasized by 25% of participants (n=3; 1 representative from UBC Food Services and 2 researchers), while 16.7% of participants (n=2; 1 representative from UBC Sprouts and the UBC Climate Hub respectively) mentioned the importance of **aligned values between producers and procurers**. Specific to procurement and commercialization, 25% of participants (n=3; 1 representative from the CFFS Action Team and UBC Sprouts respectively, as well as 1 researcher) mentioned **local foods**, while 16.7% of the participants (n=2; all representatives from the CFFS Action Team) mentioned **third-party certified biodiverse and resilient foods**. Other key sub-themes include **reduced food waste**, mentioned by 16.7% of participants (n=2; 1 representative from the CFFS Action Team and UBC Sprouts respectively), as well as reduced packaging waste, mentioned by 16.7% of participants (n=2; 1 representative from the CFFS Action Team and UBC Sprouts respectively). **Accessible food pricing**, mentioned by 25% of participants (n=3; 1 representative from the CFFS Action Team and the UBC Climate Hub respectively, as well as 1 researcher). Information of all sub-themes identified can be found in Table D-2 (Appendix D).

3.1.2 GAPS AND BARRIERS WITH BIODIVERSE FOOD PROCUREMENT

Department- and organization-specific

A total of 10 participants—including representatives from the CFFS Action Team, UBC Sprouts, and the UBC Climate Hub, as well as researchers—were asked what gaps and barriers currently exist to achieve their ideal biodiverse food procurement within their departments and organizations. Six key themes were identified from their responses, as shown in Table D-3 (Appendix D): i) financial barriers (6 mentions); ii) barriers to prioritize biodiverse food procurement in work (6 mentions); iii) challenges related to consumer demands and values (5 mentions); iv) challenges with current knowledge in biodiverse food procurement (3 mentions); v) challenges with procuring certain foods (2 mentions); vi) knowledge-to-action gaps (2 mentions).

Specific to financial barriers, a **perceived increase in procurement costs** were mentioned by 20.0% of participants (n=2; 1 representative from UBC Food Services and UBC C+CP respectively), while **food accessibility concerns for students due to perceived increased cost** were also expressed by 20.0% (n=2; 1 representative from UBC Wellbeing and the UBC Climate Hub respectively). For barriers to prioritize biodiverse food procurement in work, **lack of funding** was mentioned by 30.0% of participants (n=3; 1 representative from UBC Sprouts and the UBC Climate Hub respectively, as well as 1 researcher), while **lack of time and capacity** was mentioned by 20.0% (n=2; 1 researcher and 1 representative from UBC Sprouts). In relation to consumer demands and values, **low expected consumer demands for biodiverse foods** were mentioned by 20.0% of participants (n=2; all representatives from UBC Food Services), while the **lack of societal understanding of the importance of biodiversity in food** was mentioned by 20.0% (n=2; 1 representatives from the UBC Botanical Garden and UBC Sprouts respectively). Furthermore, a **lack of knowledge of how and where to source biodiverse foods** was mentioned by 20.0% of participants (n=2; 1 representative from the UBC SEEDS Sustainability Program and UBC C+CP respectively). Information on all sub-themes identified can be found in Table D-3 (Appendix D).

UBC-specific

A total of 7 participants—including representatives from the CFFS Action Team, UBC Sprouts, and the UBC Climate Hub, as well as researchers—were asked what gaps and barriers currently exist to achieve their ideal biodiverse food procurement at UBC. Six key themes were identified from their responses, as shown in Table D-4 (Appendix D): i) challenges with current knowledge in biodiverse food procurement (5 mentions); ii) financial barriers (3 mentions); iii) lack of prioritization of biodiverse food procurement (3 mentions); iv) challenges related to consumer demands and values (2 mentions); v) knowledge-to-action gaps (1 mention); vi) lack of student engagement (1 mention); and vii) need for systemic change (1 mention). All sub-themes were mentioned by 14.3% of the participants (n=1), and further information about them can be found in Table D-4 (Appendix D).

3.1.3 DEMANDS TO ACHIEVE BIODIVERSE FOOD PROCUREMENT

A total of 10 participants—including representatives from the CFFS Action Team and UBC Sprouts, as well as researchers—were asked how biodiversity and resilience could be best supported in food procurement. As seen in Table D-5 (Appendix D), demands were provided by the participants for: i) individual departments and

organizations; ii) a collaborative approach between departments and organizations; and iii) the university administration. Three key themes for the first category include: i) development of a biodiverse food procurement strategy (2 mentions); ii) financial support for procurement (1 mention); and iii) internal reflections (1 mention). For the second category, coordinated strategies (3 mentions) were identified as a key theme. More specifically, 20.0% of participants (n=2; 1 representative from the UBC SEEDS Sustainability Program and the UBC Botanical Garden respectively), mentioned the desire for a **framework for a circular food system**. For the last category, three key themes were identified: i) specific and targeted support for biodiversity (6 mentions); ii) making public statements (3 mentions); and iii) financial support for students (1 mention). Specific to the second theme, the impact that the university administration could have by **signing a charter** (such as the CFFS Charter) was emphasized by 20% of the participants (n=2; 1 representative from UBC Food Services and the UBC SEEDS Sustainability Program respectively). Further information about the sub-themes identified can be found in Table D-5 (Appendix D).

A total of 5 participants—including representatives from the CFFS Action Team and UBC Sprouts, as well as researchers—were asked what the top and most impactful actions that UBC can take to ensure a biodiverse food procurement strategy would be. Five key themes were identified from their responses, as shown in Table D-6 (Appendix D): i) further considerations in current food procurement strategy (5 mentions); improved biodiversity assessment strategies (4 mentions); iii) financial support for procurers (2 mentions); iv) financial support for students (2 mentions); v) widespread knowledge of biodiversity and biodiverse foods (1 mention). All sub-themes were mentioned by 10.0% of the participants (n=1), and further information about them can be found in Table D-6 (Appendix D).

3.2 SECONDARY DATA RESEARCH FINDINGS

3.2.1 WHY BIODIVERSITY IS IMPORTANT TO OUR FOOD SYSTEMS

Overexploitation and agriculture are currently the greatest threats to biodiversity (Maxwell et. al., 2016). Since the 1900s, around 75% of plant genetic diversity has been lost as farmers have opted for genetically uniform and high-yielding varieties (FAO, 1999). This loss of biodiversity is not unknown, and there are promising practices that can contribute to a better and more diverse agricultural landscape.

Biodiversity can be split into three levels: the ecosystem, the species, and the genetic diversity (BC ARDCorp, 2019). Its benefits to agriculture have been increasingly studied, and these include soil formation and retention processes, nutrient breakdown, storage and cycling, reduction of pest populations, as well as pollination services.

3.2.2 CERTIFICATIONS THAT PROMOTE BIODIVERSITY

Certifications serve as indicators for the practices that farms are employing and offer reliability on their claims. Although there is no certification that directly pertains to biodiversity, there are many that include it in its requirements and benefits. The most relevant certifications to biodiversity found include: Canada Organic, Regenerative (Ecological Outcome Verification and Regenerative Organic Certification), Bird Friendly, Rainforest Alliance Certified, and Salmon-Safe. These will all be outlined in Appendix E, but published articles indicate that all these certifications directly promote biodiversity and can be used to procure more biodiverse foods for campus.

3.2.3 FARM PRACTICES THAT INCREASE BIODIVERSITY

Although certifications offer an easy way to determine farm practices, they are not the only method. Especially for smaller farms, there is a cost barrier to obtaining these (Oya et. al., 2017). Other promising practices were found as alternative methods to seek out in farms, which include but are not limited to: crop rotation, cover cropping, perennial cover, intercropping, and agroforestry (BC ARDCorp, 2019). Perennial crop fields have specifically been found to be correlated with increased biodiversity due to the reduced disturbance of soil and increased provisioning of important insect and animal habitats (Martin et al., 2020). Purchasing perennial foods can contribute to healthier and more biodiverse agroecosystems.

In addition, studies that compared industrial farming to traditional farming systems conclude that returning to more traditional practices will aid in biodiversity conservation (Ribeiro et al., 2016). As a brief overview, industrial farming is the intensification of crop production on farms through large scale single-crop systems (monoculture/monocropping) that typically entails the use of chemical pesticides and land-exhaustive management (Hawkins, 2018). Traditional farm systems, on the other hand, promote land heterogeneity through the production of diverse crops, moderate livestock density, and reduced chemical usage (Ribeiro, 2016; Martin et al., 2020). Traditional farm systems not only promote on-farm biodiversity, but also serve as a sanctuary for

local birds and pollinators (Ribeiro et al., 2016). Utilizing farming practices that are more sensitive to the land alongside traditional diversification of crops on farms could serve as a model for biodiversity-friendly farms.

3.2.4 ENVIRONMENTAL SCAN: PROMISING PRACTICES

Just as UBC has focused on sustainability areas outside of biodiversity until recently, this is a relatively novel concept to consider at many other institutions as well. The trend of focus on other sustainability-related priorities that was found in the primary results is also observed in the environmental scan. Many priorities are shared across institutions including: Local, seasonal, certified, animal welfare, fair trade, organic, and carbon emissions (Appendix H). Of the institutions examined, two include reference to biodiversity in food systems (UVic, 2019; UA, n.d.). In their supplier code of conduct, UVic (2019) states that supplies will "Seek out industry-leading practices aimed at conserving natural biodiversity. Unfortunately, further elaboration on this priority is not provided. UA (n.d.) also states that institutional procurement preference will be given to farmers and processors that "protect and enhance wildlife habitat and biodiversity." Again, there is unfortunately no elaboration on this priority. It is notable that the somewhat older documents (2014-2018) do not include mentions of biodiversity (Appendix H).

As previously stated, biodiversity in the food system is relatively novel. Despite this, several promising practices were identified by the environmental scan. These practices are generally aimed at addressing other sustainability goals but could be modified to apply to biodiversity. There is some overlap between institutional practices identified in the primary results and the practices identified (Appendix H). Some of the relatively novel practices found include: Institutions reserving the right to terminate contracts with producers that do not follow a code of conduct, educational programs for staff and faculty, and institutional food procurement audits (UVic, 2019; McGill University, 2020; Megens et al., 2020).

3.2.5 FOODS THAT SUPPORT BIODIVERSITY

Studies have shown that eating a diet that is rich in plant-based foods can help to aid in biodiversity conservation (Hawkins, 2018; Machovina et al., 2015). Primarily, eating animal-based foods requires more land and caloric density to feed the livestock that in turn feed the human population. (Hawkins, 2018). Consumption of meat has increased, and thus space needed to feed and house livestock has led to habitat destruction worldwide

(Machovina et al., 2015). In fact, Machovina (2015, p.420) states that "livestock production is the prominent driver of natural habitat loss worldwide". The Amazon Rainforest is experiencing biodiversity loss at an unprecedented rate due to human uses with over one-third of converted land being used for pasture land (Machovina, et al., 2015). This land use is further extended due to the need to grow crops specifically designed to feed livestock, meaning it is not used to grow foods for human consumption (Machovina et al., 2015). On a consumer level, choosing plant-based options supports eating at the lower end of the trophic pyramid (see Appendix F) where there is a greater amount of caloric availability (Hawkins, 2018). Eating a greater amount of plant-based foods can be seen as more efficient as it requires overall less land usage by comparison to livestock and can be more diverse in terms of micronutrient density (Hawkins, 2018). As seen within recent literature, sourcing more plant-based foods appears to support biodiversity conservation due to lower land use requirements by comparison to animal-based foods.

3.2.6 DOES BIODIVERSE FOOD PROCUREMENT COST MORE?

To evaluate the procurement costs of foods that promote biodiversity, certifications are used to discriminate between farms that are "biodiverse" or not. The focus is on organic certifications as they are widespread, and organic agriculture was identified as an indication of biodiversity on farms (Bartram & Perkins, 2003; Underwood et al., 2011; Put et al., 2018. For organic producers, the premium price of organic products is one of the driving factors in farm conversion (Durham & Mizik, 2021). Organic farms generally reduce input costs, but also product yields. For organic farms to be financially successful, they rely on premium prices to offset lower yields (Durham & Mizik, 2021). A consumer product analysis from Lee et al. (2021) found that, on average, organic retail prices are 60% higher than conventional produce. An economic analysis by Kalaitzandonakes et al. (2018) also found that premium prices exist for organic and non-GMO foods. Applying economic theory, Kalaitzandonakes et al. (2018) suggest that these price premiums will remain even as the market for organic or non-GMO products expands. It is important to note, however, that producers selling locally could effectively reduce supply chain and therefore retail costs (Lee et al., 2021).

As mentioned in section *3.2.5*, plant-based diets can be beneficial to the conservation of biodiversity (Hawkins, 2018; Machovina et al., 2015). Using data across 150 countries from the International Comparison

Program, Springmann et al. (2021) found that "sustainable and healthy" (pescatarian, vegetarian, vegan) diets are, on average, 22-34% lower cost in upper-middle to high-income countries and 18-29% higher in lower-middle to low-income countries. Within this analysis, they found that vegan and vegetarian diets were more affordable compared to pescatarian diets that were least affordable. These findings suggest that in the context of the UBC food system, vegan and vegetarian diets could be provided at lower costs. This is somewhat supported by a study by Hyder et al. (2017). Assessing grocery costs for plant-based diets in the Western United States, they found a minimal average cost increase of $1.22/person/week. Although they did not find that plant-based diets are available at lower costs, their findings suggest that a shift to plant-based diets would not have a large financial impact.

3.2.7 HOW DOES PRODUCER LOCALITY IMPACT BIODIVERSITY?

Within British Columbia, there is generally no connection that can be assumed between local producers and practices that promote biodiversity. Local producers can operate many different types of farms and use a variety of techniques (conventional, organic, agroforestry, permaculture, etc.). There are regulations as to the chemical products that can be applied (GovBC, n.d.), however, following these regulations is not enough to promote biodiversity. The use of many approved/regulated pesticides are drivers of biodiversity loss of insect populations (Brühl & Zaller, 2019). The positive effects of organic agriculture on biodiversity are not always driven by the differences in pesticide or synthetic fertilizer use, and landscape features play a significant role (Underwood et al., 2011; Bengtsson et al., 2005; Gabriel et al., 2010). The province does provide a guide to promoting on-farm biodiversity (ARDCrop, 2021), however, there is no measurement or enforcement of these guidelines. Of course, some local producers will promote biodiversity, but these producers must be individually identified, and locality should not be used alone to indicate sustainability.

Greenhouse gas emissions are often referenced in support of local sourcing and biodiversity. Reduced greenhouse gasses could reduce overall climate change and associated biodiversity loss (EU, n.d.). It is suggested that reducing food transport distances could be effective to reduce food systems emissions. However, transport is estimated to contribute only around 15% of agriculture-associated greenhouse gasses (GHG's), while production

is responsible for around 83% of agriculture-related GHG's (Weber & Matthews, 2008). This suggests that the methods of agricultural production are more impactful towards sustainability than the distance food travels.

4. DISCUSSION

4.1 ANALYSIS OF RESULTS

4.1.1 EDUCATION

Our primary findings emphasize four main areas of biodiverse food procurement: education, sustainability, institutional change, and financial costs. Regarding the first area, there is a general consensus on the need to connect the increasing dissociation between producers and consumers of food. Engaging students of the UBC community could be achieved through campus-wide education initiatives on biodiversity and plant-based foods, which was proposed by representatives from UBC Food Services (Table D-5 in Appendix D). As explained by our secondary data, there has been a global increase in consumer desire to purchase organic foods, which is supported by the fact that consumers understand there are ethical, health, and environmental benefits to purchasing foods with an organic label (Talwar et al., 2021). Therefore, UBC's efforts in extending this to the importance of purchasing biodiverse-friendly foods could lead to similar results. By understanding the imperativeness of biodiversity in building sustainable and climate-resilient food systems, we can work towards more motivated, collective action between all stakeholders and influence a consumer-based shift, as a high meat demand was one of the challenges mentioned by the CFFS action team.

Having said this, there are many barriers to such an educational endeavor. Primarily, researchers have stated a lack of capacity for participation despite interest in involvement. This includes time restraints as well as lack of funding to implement biodiversity educational tools for students (Table D-3 in Appendix D). Furthermore, knowledge gaps exist amongst practitioners themselves too. Interviewees discussed the need for an improved understanding of biodiversity, its assessment strategies, emission calculation methodology, and research integration across campus, to help inform policies and guidelines (Table D-4 in Appendix D).

As was overviewed within the secondary research (see section 3.1.2), there is no singular certification that labels foods or farms as certified biodiversity-friendly. This can be connected to themes that emerged

through our primary data analysis. Multiple practitioners emphasized the need for a clear definition of biodiverse foods, as well as universal metrics for tangible indicators of biodiversity on farms (Table D-4 in Appendix D). There is an opportunity for these clear definitions and metrics to aid in other areas of concern expressed by practitioners. To expand, there was mention of implementing clear policies related to biodiversity from a research practitioner (Table D-4 in Appendix D). An informed policy could require clear metrics for farms to follow in order to be certified biodiversity-friendly as can be seen from other established labels (Appendix E). Creating a clear definition of biodiverse foods can aid in supporting universal metrics through common understanding, which is seen in the implementation of alternate food labels and is desired amongst on-campus practitioner groups.

An overarching theme that has emerged from the data is that biodiversity is a complex and multilayered issue that will require systemic shifts in order to facilitate biodiversity education and implementation. To expand, practitioners have stated that there needs to be a top-down approach to biodiversity education in order to facilitate change amongst organizations and the student population on campus (Table D-4 in Appendix D). This creates grounds for the practitioner's recommendation that multidimensional education on biodiversity and resilience is necessary to help those who access the UBC food system understand the importance of this sustainability measure. The practitioner recommendations include the UBC administration taking public actions to prioritize biodiversity, such as through signing charters and making endorsements. Not only would these types of actions provide budget incentives for departments and organizations within campus involved in this work, but would also help promote funding allocations to education on biodiversity to the UBC population or other support to this goal. Education appears to be a critical tool to support biodiversity within UBC's complex food system as biodiversity remains a complex and multidimensional sustainability indicator.

4.1.2 ENVIRONMENTAL SUSTAINABILITY

Aligning plans for a biodiverse food procurement strategy also calls for a consideration of environmental impacts and sustainability, proving the vital role of biodiversity in ecosystems. Our primary data shows that in an ideal world, this would mean minimizing food and packaging waste as well as our carbon footprint (Table D-2 in Appendix D), conserving ecosystems and food plant diversity (Table D-1 in Appendix D), and ensuring a circular food system, which were all outlined by members of the CFFS Action Team. Most aspects of biodiverse food

procurement ultimately lead to effects that positively feed into ecosystem health, both directly and indirectly. Inviting biodiverse foods into the food spaces at UBC will undoubtedly support our natural world, especially in the ever-changing face of climate change.

As has been noted, biodiverse food is a complex topic that can take on many different meanings and looks different from farm to farm. In our primary data collection, it became clear that local foods are seen as biodiverse foods (Table D-2 in Appendix D). However, it is clear that these two terms cannot be equated when looking at farms within British Columbia (see section 3.2.7). Studies have shown that BC has regulations that limit various chemical and pesticide uses, yet this cannot guarantee that a farm meets other important biodiversity standards. For example, a BC farm that follows chemical regulations may still practice monocropping amongst other conventional agriculture trends. As was researched during secondary data collection, there are many on-farm practices that support biodiversity on farms (see section 3.2.3). Supporting local farms may have environmental benefits, but these benefits cannot be directly related to biodiversity conservation on farms. There are other metrics required to determine if a farm is supporting biodiversity that goes beyond sourcing locally.

4.1.3 COLLABORATION AND INSTITUTIONAL CHANGE

From a logistical standpoint, UBC must commit to being action-oriented and facilitating greater collaboration between stakeholders. Several demands for the university administration implied the need for internal reform and making public statements in support of biodiverse food procurement. Developing department- or organization-specific goals and establishing a faculty position responsible for aspects of the strategy were proposed by UBC Food Services and researchers, respectively (Table D-5 in Appendix D). A top-down approach from the university should be used through publicized support initiatives in the form of making endorsements, implementing a signing charter, administering biodiversity education (see section 4.1.1), and creating seed and plant breeding programs, to name a few (Table D-5 in Appendix D). Interviewees also expressed a desire for increased collaboration between different working groups, departments, and organizations to establish similar goals, and between researchers and practitioners as well. This insight from our primary data demonstrates that a top-down approach needs to be used by leadership at UBC who are not afraid to make the changes necessary in order to advance biodiversity in food systems.

4.1.4 FINANCIAL COSTS

In the realm of finances, the concerns and potential opportunities related to funding appeared in nearly every question that was asked to our research participants—whether it was in the form of financial barriers or support. When asked about the gaps and barriers to obtaining an ideally biodiverse food procurement strategy, several interviewees highlighted the perception of increased procurement and consumer costs (Table D-3 in Appendix D). This perception is supported when the term "biodiverse foods" is equated to "organic produce" (see section 3.1.2). Organic certification requirements, such as limited uses of chemicals and pesticides (see Appendix E), may allow for farms to fall more in line with traditional farming systems meaning that purchasing organic foods may be beneficial in supporting a biodiverse food system. However, studies have shown that organic foods cost 60% more on average than non-organic produce (Lee et al., 2021). This research would then support the notion that choosing biodiversity-friendly foods could be a more expensive option that would require increases in funding, procurement incentives, and student/faculty subsidies. However, the literature shows that there are many factors that lead to a farm supporting biodiversity outside of being certified organic (see section 3.1.2). Plant-based diets may not result in large costs increases for procurement and may be an area of opportunity considering the identified financial barriers (section 3.2.6). Overall, Implementing biodiversity-friendly foods into large-scale university procurement strategies is a new field of research meaning that it is not clear whether or not these foods will be more expensive in the long run.

Overcoming these barriers would call for financial support for both stakeholders involved in procurement and students on campus. For the former, this could come in the form of budget incentives, as mentioned by a representative from the UBC SEEDS Sustainability Program (Table D-5 in Appendix D), and purchasing policy incentives, which was said by a researcher (Table D-6 in Appendix D). For students, supporting adequate income and ensuring financial accessibility of biodiverse foods was proposed by a representative from UBC Wellbeing (Tables D-2 and D-5 in Appendix D), in addition to possible subsidization of these foods (Table D-2 in Appendix D). These results demonstrate that money and more specifically, equitability, is an important consideration at various stages of the procurement process and among those involved in the UBC food system.

4.2 DATA LIMITATIONS

There is great opportunity for growth within the field of on-campus food system biodiversity. Our research has been limited by several factors including a primary time restraint. The research took place over the span of approximately three months, meaning that our findings are non-exhaustive. Adding to this research in the future could entail a longer time frame to incorporate a more diverse and exhaustive list of research participants and student focus groups. Meeting with more on-campus representatives and relevant student groups could greatly enhance this research from a consumer perspective.

It should also be noted that our research is limited by varying modes of communication with interviewees. Our participants communicated through live interviews, written email questionnaire correspondence, or focus group conversation (see section 2.1). These different methods of communication led to differences in questions asked and style of responses. In certain questions, this created difficulty in drawing direct comparisons between participant responses. A longer time frame to establish participant interviews and focus groups could alleviate the issues of communications over email as this was a solution used to give participants an alternative to interviews that they did not have the capacity for. The different modes of communications created limitations to the direct comparisons that could be drawn from participant responses creating a smaller pool of interview questions to select from within the primary data analysis (see section 3.1.1).

5. RECOMMENDATIONS

5.1 RECOMMENDATIONS FOR ACTION AND IMPLEMENTATION

Based on the results of our project, we have created a set of standards for the UBC Food Services Purchasing Team to follow. They are grouped into two categories: short and mid-term (over the next 6-12 months) and long-term (1-3 years) to guide the more specific and immediate changes to food procurement as well as the institutional and broader actions to pursue. We included areas of research that would be beneficial for future projects but that we were unable to address.

Short and mid-term:

1. Look for eco-labels (Appendix E)

2. Perennial crops over annuals
3. Diversify foods and varieties
4. Diversify suppliers
5. Buy directly from farmers
6. Buy seasonally

Long-term:

1. Support ecological farms
2. Create a Biodiversity Action Charter
3. Create a permanent paid position

Future research:

1. Increased cost of procuring biodiverse foods
2. Connections between locality, biodiversity, and other sustainability priorities

5.2 STANDARDS FOR PURCHASING

5.2.1 CHECK FOR LABELS (APPENDIX E)

While there are many eco-labels out there, and none directly indicate biodiversity, buying Certified Organic produce is one clear metric that can be used by Food Services purchasers when analyzing supply options. Organic farms have been shown to support higher levels of biodiversity on average due to a combination of many ecological farming practices such as reduced tillage, landscape heterogeneity, crop rotations, limited chemical use, and others (Bartram & Perkins, 2003; Underwood et al., 2011; Put et al., 2018). While this trend has been found across many study areas, organic agriculture is not always better for biodiversity than conventional agriculture if the farm in question enlists other beneficial practices, but this can be used as one factor to guide purchasing decisions. See Appendix E for a compiled list of biodiversity-related eco-labels and related supply information. Reference Appendix G for the member list of the Fraser Valley Organic Producers Association.

5.2.2 INCORPORATE MORE PERENNIAL FOODS

As discussed in our secondary research findings (see section 3.1.2), perennial crops require farming practices that tend to lead to higher biodiversity across the farm, with other environmental benefits as well (Martin et al. 2020). An immediate action UBC can do is to incorporate more perennial crops into their menus and

use them to replace other annual vegetables, which the residence dining halls already seem to do to an extent. For an initial list, some crops that grow perennially in BC's local growing zone include: artichoke, broccoli, kale, sweet potato, cabbage, collards, sunchokes, chicory, and watercress (White, 2022). These kinds of crops also have other benefits for climate resilience, because they tend to be more resistant to drought, better able to access nutrients and water, and can store and sequester carbon belowground year-to-year (Zhang et al., 2011).

5.2.3 CHOOSE DIVERSE VARIETIES

One component of biodiversity on the farm is genetic diversity, which can sometimes come in the form of growing different cultivars of crops in the fields (Pautasso, 2013; Smale et al., 2001). This can be incorporated into UBC's CFFS Purchasing Strategy by diversifying orders to include foods of many varieties, which can be as simple as purchasing multiple cultivars of kale, for example, curly kale and lacinato kale, rather than bulk-buying one variety. This supports farmers who are growing diverse crops, while also bringing novelty to the menu.

5.2.4 DIVERSIFY SUPPLIERS

Another action UBC can take is to continue to diversify its suppliers. This practice would be beneficial for increasing resilience across UBC's supply chain, as buying from many different farms helps to ensure that there are many options in the face of uncertainties and climate effects. Though it may require more time in the purchasing process (see 5.2.7), it would also allow UBC to support many smaller farms which tend to support higher on-farm biodiversity (Ricciardi et al., 2021).

5.2.5 BUY DIRECTLY FROM FARMERS

In today's agricultural marketing system, farmers often are at an economic disadvantage with the minimal profit they receive for their crops, which is exacerbated by actors in the middle who dictate purchasing and selling between farmers and the actual consumers/purchasers (Brown & Miller, 2008). Through this system, the crops that farmers grow are partially dictated by those sellers as the market force, which can prevent them from growing the varieties and species that they may ordinarily choose (Pascuala & Perrings, 2007). Thus, by buying directly from farmers, they will receive a greater profit and may be more able to budget resources into

biodiversity-enhancing practices as well, as cost can be a barrier otherwise (Brodt et al., 2009). A complete member list of the Fraser Valley Organic Producers association can be found in Appendix G.

5.2.6 BUY SEASONAL WHEN POSSIBLE

During primary data collection, a recommendation that emerged was prioritizing the purchase of seasonal foods (see section 3.1.1). As identified by the environmental scan, seasonality is also a common priority at other institutions (Appendix H). This entails strategizing the procurement of food to support purchasing produce during its growing season. The goal in doing so is to give further incentive to support local farms that sow multiple crops for harvest at varying points in the year. This recommendation will require further research as there is no current literature to support the connection between purchasing seasonal food and biodiversity. The term "seasonal" requires parameters that define whether the food is locally in season (referring to British Columbia) or globally in season (referring to the place in which the produce is grown) (EUFIC, 2020). Implementing this recommendation immediately could entail promoting seasonal menus on the UBC campus which cater to foods that are locally in season. In the long run, a procurement strategy could devise a plan for produce that is not grown in BC to be purchased during its natural growing season from local farmers of that region. Again, there is opportunity for further research to support this recommendation from an academic literature perspective.

5.2.7 LONG-TERM RECOMMENDATIONS

a. Support ecological farms

This recommendation comes as an overarching goal to work towards in UBC's purchasing strategies. We have laid out several criteria for what ecologically-minded farms look like (see section 3.2.3), and there should be an examination of the farms that UBC buys from to investigate whether these suppliers are utilizing these beneficial farm practices. This was out of the scope of our project but would benefit from the implementation of the recommendation below (see section 5.2.7c).

b. Biodiversity Action Charter

UBC has made great progress in institutionalizing its support for climate action via the Declaration on the Climate Emergency and subsequent climate policy plans. However, this is lacking in the sphere of biodiversity and

a positive step UBC could take is to form a statement of support and create a Biodiversity Action Charter. This would be a commitment to action to protect biodiversity within UBC's university operations and networks, setting the scene for concrete policies to be put in place and leading the way for other post-secondary universities where this has also yet to be adopted. It would also elevate biodiversity as a priority, as it still is not as widely understood by the general public in the same way that greenhouse gasses and climate change have and this could establish a helpful baseline for comprehension by the UBC community at large. Instead of creating an entirely new charter, however, an opportunity also exists in the CFFS Charter that is currently being drafted but has a lot of room for greater emphasis on and action towards biodiversity.

c. Create a permanent paid position

One recommendation brought up in our primary data collection was for UBC to create a permanent staff/faculty position dedicated to enhancing biodiversity, especially because of the stated lack of capacity within current faculty despite their interest to be involved. This was recommended during our data collection in the context of research in crop production at UBC but would be greatly beneficial if there were a permanent position related to food procurement and food services on campus. This person, whether it be through a paid responsibility added to an existing position or a new one entirely, would identify suppliers for UBC to buy from whose crops are produced in a way that supports biodiversity—looking into some of the metrics proposed above and the farm practices described in section 3.2.3. Support for this suggestion also originates in the barrier identified by Food Service representatives that there is not enough time for them to spend investigating biodiverse food purchasing options given all of their other responsibilities, which is why the specific allotment of funds towards this duty is an important step to take. Further benefits come from the increased communication and engagement that would take place between different groups across campus, such as between researchers, chefs, students, and procurement managers, to inform the biodiversity lens and balance community needs.

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

5.3.1 INCREASED COST OF PROCURING BIODIVERSE FOODS

One of the most common barriers cited to the adoption of biodiversity-friendly food procurement was the anticipated cost. From the perspective of practitioners as well as some researchers and other participants,

biodiversity-friendly food is expected to be more expensive to purchase on the side of UBC Food Services, which would then lead to increased prices for the students. While this may be true for organic foods (Lee et al., 2021), other aspects of biodiversity-promoting procurement, such as plant-based diets, may not be significantly most expensive (Springmann et al., 2021; Hyder et al., 2017). There is a wide variety of food system characteristics that can contribute to biodiversity (on-farm practices, perennial systems, certifications) (Section 3.2), and there is no readily available data to indicate the impacts on food system costs. This is therefore an area that would benefit from further research and budget analysis but was beyond the scope of our project.

5.3.2 CONNECTIONS BETWEEN LOCALITY, BIODIVERSITY, AND OTHER SUSTAINABILITY PRIORITIES

Based on our results, one research recommendation is to develop a prioritization method for UBC groups to evaluate overall food system sustainability. As detailed in the secondary data findings (Section 3.2), there is not necessarily a clear connection between food system aspects such as locality and biodiversity. While locality in food systems can be beneficial for supplier costs and access to seasonal foods (Lee et al., 2021), local producers may not benefit from biodiversity (Section 3.2.7). This situation could be applied to other priorities for sustainable food systems identified by the environmental scan (Appendix H), such as reduced emissions, quality meat sourcing, social justice, and fair trade. What's considered the "best" and "most sustainable" foods and sources may be misaligned depending on which metric the purchaser is prioritizing, so the challenge of balancing these potentially competing interests presents an opportunity for further research. In order for UBC groups to promote overall sustainability while considering many different factors, institutional research and development of prioritization methods to inform decision making could be effective.

6. CONCLUSION

Biodiversity within food systems is a complex and evolving realm of research. At UBC, plans for a Climate-Friendly Food System (CFFS) have made this clear. Through a literature review and environmental scan, it became apparent that implementing biodiversity into food procurement is a relatively new field of research with a great deal of opportunity for expansion. Having said this, research in other similar areas has brought clarity to pathways for success in food system biodiversity moving forward, specifically in the following areas: 1) farm practices that can benefit overall on-farm ecosystem health (see section 3.2.3); 2) food labeling as an important step towards

identifying biodiverse foods; and 3) examples of promising practices being implemented at other institutions, such as educational programs, biodiversity audits, and consequences for failure to adhere to an environmental code of conduct (see section 3.2.4). Our conversations with stakeholders involved with food procurement at UBC also lent significant insight into the need for considering education, environmental impacts, collaboration, and institutional change, as well as financial costs in crafting a strategy for biodiverse food procurement. This data has collectively led us to propose time-bound recommendations for action and implementation, which include criteria and standards for purchasing foods, in addition to future recommendations for research that will advance our understanding of this topic. Ultimately, factoring biodiversity into food procurement will require significant collaborative and action-oriented efforts from all involved stakeholders and food consumers of the UBC community. We believe that by following the recommendations outlined in this report, UBC has the potential to become an exemplary institution when it comes to promoting biodiversity and climate-resilient food systems.

REFERENCES

Bartram, H., & Perkins, A. (2003). The biodiversity benefits of organic farming. *Organic Agriculture: Sustainability, Markets and Policies, 77*, 77-93.

BC Agricultural Research and Development Corporation. (2021). Environmental Farm Plan Program Reference Guide. Retrieved from: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/environmental-farm-planning/efp-reference-guide/full_efp_reference_guide.pdf

Bengtsson, J., Ahnström, J., & Weibull, A. C. (2005). The effects of organic agriculture on biodiversity and abundance: a meta-analysis. *Journal of Applied Ecology, 42*(2), 261-269.

Brodt, S., Klonsky, K., Jackson, L., Brush, S. B., & Smukler, S. (2009). Factors affecting adoption of hedgerows and other biodiversity-enhancing features on farms in California, USA. *Agroforestry Systems, 76*(1), 195-206.

Brown, C., & Miller, S. (2008). The impacts of local markets: A review of research on farmers markets and community supported agriculture (CSA). *American Journal of Agricultural Economics, 90*(5), 1296-1302.

Brühl, Z.A., Zaller, J.G. 2019. Biodiversity Decline as a Consequence of an Inappropriate Environmental Risk Assessment of Pesticides. *Front. Environ. Sci.: 177*, https://doi.org/10.3389/fenvs.2019.00177

Burns, J., Cooke, D., & Schweidler, C. (2011). *A short guide to community based participatory action research*. Advancement Project - Healthy City Community Research Lab. https://ktpathways.ca/resources/short-guide-community-based-participatory-action-research

CAP 2030. (2021). Climate Action Plan 2030. University of British Columbia. https://planning.ubc.ca/sites/default/files/2021-12/UBCV_CAP2030_FINAL.pdf

Campbell A., Chenery A., Coad L., Kapos V., Kershaw F., Scharlemann J.P.W., Dickson B., UNEP-WCMC, & Biodiversity Heritage Library. (2008). Linkages between biodiversity and climate change mitigation: A review of the recent scientific literature.

Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., & Leip, A. (2021). Food Systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food, 2*(3), 198–209. https://doi.org/10.1038/s43016-021-00225-9

Damayanthi, S. (2019). Thematic analysis of interview data in the context of management controls research. In SAGE Research Methods Datasets Part 2. SAGE Publications, Ltd. https://dx.doi.org/10.4135/9781526474858

Dudley, N., & Alexander, S. (2017). Agriculture and biodiversity: A review. *Biodiversity (Nepean), 18*(2-3), 45-49. https://doi.org/10.1080/14888386.2017.1351892

Durham, T.C., Mizik, T. (2021). Comparative Economics of Conventional, Organic, and Alternative Agricultural Production Systems. *Economies 2021, 9*(2), 64. https://doi.org/10.3390/economies9020064

Eufic. (2020, September 9). *Are seasonal fruit and vegetables better for the environment?* Eufic. Retrieved April 16, 2022, from https://www.eufic.org/en/healthy-living/article/are-seasonal-fruit-and-vegetables-better-for-the-environment

European Commission. n.d. Biodiversity and Climate CHange. Retrieved from: https://ec.europa.eu/environment/nature/climatechange/index_en.htm

FAO. (2009). The state of Food and Agriculture. Retrieved January 30, 2022, from https://www.fao.org/3/i0680e/i0680e.pdf

FAO. (1999). Women – users, preservers and managers of agrobiodiversity. Retrieved April 13, 2022, from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.395.2601&rep=rep1&type=pdf

Gabriel, D., Sait, S. M., Hodgson, J. A., Schmutz, U., Kunin, W. E., & Benton, T. G. (2010). Scale matters: the impact of organic farming on biodiversity at different spatial scales. *Ecology Letters, 13*(7), 858-869.

Government of British Columbia (GovBC). N.d. Pesticide Use. Environmental protection and sustainability. Retrieved from: https://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management/pesticide-use

Hawkins, I.W. (2018). Promoting Biodiversity in Food Systems: A Textbook in Tribology (1st ed.). CRC Press. https://doi.org/10.1201/b22084

Hyder, J. A., Thomson, C. A., Natarajan, L., Madlensky, L., Pu, M., Emond, J., Kealey, S., Rock, C. L., Flatt, S. W., Pierce, J. P., & WHEL Study Group (2009). Adopting a plant-based diet minimally increased food costs in WHEL Study. *American Journal of Health Behavior, 33*(5), 530–539. https://doi.org/10.5993/ajhb.33.5.6

Isbell, F., Craven, D., Connolly, J., Loreau, M., Schmid, B., Beierkuhnlein, C., Bezemer, T. M., Bonin, C., Bruelheide, H., de Luca, E., Ebeling, A., Griffin, J. N., Guo, Q., Hautier, Y., Hector, A., Jentsch, A., Kreyling, J., Lanta, V., Manning, P., … Eisenhauer, N. (2015). Biodiversity increases the resistance of ecosystem productivity to climate extremes. *Nature, 526*(7574), 574–577. https://doi.org/10.1038/nature15374

Kalaitzandonakes, N., Lusk, J., Magnier, A. 2018. The price of non-genetically modified (non-GM) food. Article in Press. *Food Policy.* Retrieved from: https://agroavances.com/img/publicacion_documentos/S0306919218301131.pdf.pdf

Lee, M.F., von der Heidt, T., Bradburry, J.F., Grace, S. 2021. How much more to pay? A study of retail prices of organic versus conventional vegetarian foods in an Australian regional area. *Journal of Food Distribution Research, 32*(3), 46-62.

Liu, E., Keeley, E., Bissonnette, D., & Lee, P. (2019). Climate-friendly food at UBC: best practices and policy recommendations. Open Collections: UBC Undergraduate Research. https://dx.doi.org/10.14288/1.0387087

Machovina, B., Feeley, K. J., & Ripple, W. J. (2015). Biodiversity conservation: The key is reducing meat consumption. *The Science of the Total Environment, 536*, 419-431. https://doi.org/10.1016/j.scitotenv.2015.07.022

Martin, A. E., Collins, S. J., Crowe, S., Girard, J., Naujokaitis-Lewis, I., Smith, A. C., ... & Fahrig, L. (2020). Effects of farmland heterogeneity on biodiversity are similar to—or even larger than—the effects of farming practices. *Agriculture, Ecosystems & Environment*, 288, 106698.

Maxwell, S., Fuller, R., Brooks, T. et al. Biodiversity: The ravages of guns, nets and bulldozers. *Nature 536*, 143–145 (2016). https://doi.org/10.1038/536143a

McGill University. (2020). Climate & Sustainability Strategy 2020-2025. 2020. Retrieved from: https://www.mcgill.ca/sustainability/files/sustainability/mcgillclimatesustainability2025_-_reduced.pdf

Megens, A. Roy, R., Murray, D., Cummings, H. & Associates. 2014. Institutional Local Food Procurement. A field guide for managers and cooks. Retrieved from: http://tbfoodstrategy.ca/files/3614/4975/7251/Appendix_B_-_Thunder_Bay_Local__Food_Procurement Field_Guide_for_Managers_and_Cooks_Feb_2015.pdf

Nanayakkara, S.P.M. (2021). "Climate-Friendly" Food Systems at UBC: community engagement to define and inform climate action. Social Ecological Economic Development Studies (SEEDS) Sustainability Program. https://sustain.ubc.ca/sites/default/files/seedslibrary/VOL_500_Climate-Friendly%20Food%20Systems%20at%20UBC_FinalReport.pdf

Oya, C., Schaefer, F., Skalidou, D., McCosker, C., & Langer, L. (2017). Effects of certification schemes for agricultural production on socio-Economic Outcomes in low- and middle-income countries: A systematic review. *Campbell Systematic Reviews, 13*(1), 1–346. https://doi.org/10.4073/csr.2017.3

Pautasso, M., Aistara, G., Barnaud, A., Caillon, S., Clouvel, P., Coomes, O. T., ... & Tramontini, S. (2013). Seed exchange networks for agrobiodiversity conservation. A review. *Agronomy for Sustainable Development, 33*(1), 151-175.

Pimm, S. L. (2021, December 13). biodiversity. Encyclopedia Britannica. https://www.britannica.com/science/biodiversity

Put, J. E., Mitchell, G. W., & Fahrig, L. (2018). Higher bat and prey abundance at organic than conventional soybean fields. *Biological Conservation, 226*, 177-185. https://doi.org/10.1016/j.biocon.2018.06.021

Ribeiro, P. F., Santos, J. L., Santana, J., Reino, L., Beja, P., & Moreira, F. (2016). An applied farming systems approach to infer conservation-relevant agricultural practices for agri-environment policy design. *Land use Policy, 58*, 165-172. https://doi.org/10.1016/j.landusepol.2016.07.018

Ricciardi, V., Mehrabi, Z., Wittman, H., James, D., & Ramankutty, N. (2021). Higher yields and more biodiversity on smaller farms. *Nature Sustainability, 4*(7), 651-657.

Richer, L. (2021, December 3). Climate action: Backgrounder. UBC and SEEDS.

Smale, M., Bellon, M. R., & Aguirre Gomez, J. A. (2001). Maize diversity, variety attributes, and farmers' choices in Southeastern Guanajuato, Mexico. *Economic Development and Cultural Change, 50*(1), 201-225.

Springmann, M., Clark, M.A., Rayner, M., Scarborough, P., Webb, P. (2021). The Global and regional costs of healthy and sustainable dietary patterns: A modelling study. *The Lancet Planetary Health, 5*(11), E797-E807. DOI:https://doi.org/10.1016/S2542-5196(21)00251-5

Stone, A., Boxold, L., Smith, C., & Larsen, J. (2021). Fostering a biodiverse food system: purchasing baseline and guidelines. Open Collections: UBC Undergraduate Research. https://dx.doi.org/10.14288/1.0400185

Stringer, E. T. (2004). *Action research in education*. Pearson/Merrill/Prentice Hall.

Talwar, S., Jabeen, F., Tandon, A., Sakashita, M., & Dhir, A. (2021). What drives willingness to purchase and stated buying behavior toward organic food? A Stimulus–Organism–Behavior–Consequence (SOBC) perspective. *Journal of Cleaner Production, 293*, 125882. https://doi.org/10.1016/j.jclepro.2021.125882

Underwood, T., McCullum-Gomez, C., Harmon, A., & Roberts, S. (2011). Organic agriculture supports biodiversity and sustainable food production. *Journal of Hunger & Environmental Nutrition, 6*(4), 398-423.

The University of Manitoba (UM). 2015. Food at the University of Manitoba. A summary of current activities and programs, with additional notes on challenges and opportunities. Retrieved from: https://umanitoba.ca/campus/sustainability/media/Food_At_the_University_of_Manitoba_-_Summary_of_Current_Activities_and_Programs_July_2015_FINAL.pdf

The University of Nottingham (UN). 2016. Sustainable Food Policy. Retrieved from: https://www.nottingham.ac.uk/fabs/procurement/documents/sustainable-food-policy-oct2016.pdf

The University of Winchester (UW). 2016. University of Winchester Sustainable Food Procurement Policy. Retrieved from: https://www.sustainabilityexchange.ac.uk/files/university_of_winchester_catering_sustainable_food_procurement_policy_2016.pdf

University of Alberta (UA). n.d. Sustainable Food Policy. Augustana Campus. Retrieved from: https://www.ualberta.ca/augustana/student-life/dining/sustainable-food-policy.html

University of Sussex (US). 2021. Sustainability Food and Agriculture Policy. Retrieved from: https://www.sussex.ac.uk/webteam/gateway/file.php?name=sustainability-food-and-agriculture-policy-aw.pdf&site=271

University of Victoria (UVic). 2019. University of Victoria Supplier Code of Conduct. Retrieved from: https://www.uvic.ca/purchasing/assets/docs/uvicsuppliercodeofconduct.pdf

Wallace, K.J. (2007). Classification of ecosystem services: problems and solutions. *Biological Conservation, 139*(3-4), 235-246. https://doi.org/10.1016/j.biocon.2007.07.015

Weber, C.L., Matthews, S.H. 2008. Food-Mlikes and the Relative Climate Impacts of Food Choices in the United States. *Environ. Sci. Technol. 42*(10), 3508–3513. https://doi.org/10.1021/es702969f

White, J. (2022, March 23). *41 Perennial Vegetables to Grow by Hardiness Zone*. All About Gardening. https://www.allaboutgardening.com/perennial-vegetables/

Zhang, Y., Li, Y., Jiang, L., Tian, C., Li, J., & Xiao, Z. (2011). Potential of perennial crop on environmental sustainability of agriculture. *Procedia Environmental Sciences, 10*, 1141-1147.

APPENDICES

APPENDIX A: FOCUS GROUP AND INDIVIDUAL INTERVIEW QUESTIONS

Focus Group:

1. What are the most relevant key indicators that a university can assess to understand its food-related procurement impact?
2. Have you ever considered biodiversity in your field of work? And specifically within the food system? (Sliding scale question from 1 to 10, where 1 = Never, 5 = Sometimes, and 10 = Daily)

   If answer was closer to 1:
   a. Is biodiversity something you'd like to consider in your department/organization?
   b. Are there any gaps and barriers associated with considering biodiversity in your department/organization?

   If answer was closer to 10:
   c. What areas of biodiversity and climate resilience relate to and/or are currently considered in your department/organization?
   d. Do you have any measures/indicators you use to measure biodiversity and climate resilience in your work (relating to food procurement)?

3. In a perfect world, what would a biodiverse and climate-resilient food procurement system look like within your department/organization?
4. In a perfect world, what would a biodiverse and climate-resilient food procurement system look like within UBC?
5. What gaps and barriers are preventing your department from achieving this?
6. What gaps and barriers are preventing UBC from achieving this?
7. What are your department's-/organization's-specific demands to best support biodiversity and climate resilience in food procurement?
8. From a climate mitigation and adaptation perspective, what are the top and most innovative actions the university could take through its food procurement policy that can contribute to promoting biodiverse and resilient food systems?

Researcher 1:

1. What does biodiversity mean to you?
2. What aspects of your current work are related to biodiversity and resilience in the food system?
3. In an ideal or a perfect world, what would a biodiverse and climate resilient food procurement system look like?
4. Have you experienced any gaps or barriers (either with [your program] or just at the UBC Farm in general) to achieve this most ideal perfect world/food procurement system?
5. Have you noticed any knowledge-to-action gaps or barriers, thinking about how your research can be implemented into real life actions?
6. Are you aware of any promising practices or strategies that can be implemented to further promote biodiversity and resilience, or any practices that do so in current municipal governments?
7. Do you know if you yourself, [your program], or the UBC Farm might have any specific demands to best support biodiversity and resilience in UBC's food procurement system or within the UBC system as well?
   a. Any specific demands for the university that you or [your program] would have?
8. If you could communicate to the university your top findings for supporting a biodiverse agroecosystem or biodiverse food system, then what would those be and what would you really want them to prioritize and know?
9. Regarding any ways in which biodiversity has been factored into food procurement, are you aware of any examples that have been done in other cities or institutions?

10. What are your greatest concerns for biodiversity or resilience in the food system moving forward?

Researcher 2:

1. What does biodiversity mean to you?
2. In a perfect or hypothetical world, what would biodiverse food procurement look like for you in terms of the purchasing practices for UBC Food Services?
3. In your opinion, what are the top and most impactful actions that UBC can take to ensure a biodiverse food procurement strategy?
4. What are the gaps and barriers that prevent UBC from achieving this?
5. Relating to your own research and work relating to biodiversity, what are the key findings that you would like to communicate to those who influence food procurement strategies at UBC?
6. Are you aware of any ways that UBC is currently promoting biodiversity and resilience, and more specifically with food procurement?
7. Are you aware of any promising biodiverse food procurement strategies that are being implemented in other institutions or municipalities?
8. What are your greatest concerns for biodiversity and climate resilience in the food system moving forward?

Researcher 3:

1. In a perfect world, what would biodiverse food procurement look like for you? ("food procurement" = purchasing practices for UBC Food Services)
2. What are the top and most impactful actions that UBC can take to ensure a biodiverse food procurement strategy?
3. Are you aware of any promising biodiverse food procurement strategies that have been implemented in other institutions or cities?
4. What are key findings from your own research/work relating to biodiversity that you would like to communicate to those who influence food procurement strategies at UBC?
5. What are your greatest concerns for biodiversity and resilience in the food system moving forward?

Representative from UBC Sprouts:

1. What does biodiversity mean to you?
2. How does biodiversity relate to your work at Sprouts?
3. Seeing as your organization (Sprouts) currently has your purchasing policy publicly available, do you think this transparency plays into customer purchasing decisions?
    a. Do you communicate your purchasing decisions to the people at the cafe?
4. Are you aware of any ways that UBC is currently trying to promote biodiversity and resilience, as a university and specifically within their food procurement endeavors?
5. In a perfect world, what do you think a biodiverse and climate-friendly procurement system looks like to you?
6. What are gaps or barriers preventing Sprouts from achieving this perfect world? How can UBC best support you in attaining this?
7. What are the top and most impactful actions that UBC can take to ensure biodiversity and resilience in their food procurement?

Representative from the UBC Climate Hub:

1. What does biodiversity mean to you?
2. How does biodiversity relate to your work?
3. Are you aware of any ways in which UBC is currently promoting biodiversity and resilience, specifically with food procurement?
4. In a perfect world, what would a biodiverse and climate-resilient food system look like to you?

5. What are the gaps or barriers preventing the Climate Hub from achieving this perfect world and ideal food system? (Response to this question also included gaps and barriers that come with achieving this perfect world and ideal food system from a UBC-specific standpoint).
6. What are your greatest concerns for biodiversity and resilience in the food system moving forward?

APPENDIX B: THEMATIC ANALYSIS EXAMPLE

Table B-1. Example of how codes were identified from a participants' response to one question to perform thematic analysis, following the methodology by Damayanthi (2019).

(Q5) In a perfect world, what do you think a biodiverse and climate-friendly procurement system looks like to you?	**Codes:**
Representative from UBC Sprouts: I guess I would say the biggest one is really knowing—who you're buying it from, again, I think it matters so much. You have a certain right, like, I really believe in local small scale farming. I think that, you know, it's incredibly important to reduce [food] waste wherever you can. I think, you know, something that's really interesting in terms of our food system is even just the whole idea of, like, "best before"—that's a really interesting one. In terms of, you know, knowing what your company is doing with any of their expired things, what your farm is doing [with] that—for me I always think it's really important to know. So, as a purchaser—and I did sourcing for them again—about a year at this company and when I looked to work with a company and to get them in, you know, you want to look. Not only at the product that you're trying to get, right, but you want to look at. And I think not only at the company and their goals, but what their values as a company [are], because, at the end of the day, if someone owns a farm, if they own a distributor or whatever it is like hot sauce, cereal, whatever it may be, they're doing it for a reason. And I think when you know that reason, as a purchaser, you are so much more inclined to to work with them and to build a better system for sustainable consumption of food, and I think that that is really important. And again, we've streamlined everything in our food and purchasing system so that it's easier—you know, in terms of me having worked with this company. Anyway. We were bulk in store and [have] bulk food—it's not the norm, right? So, [for things that do not come in bulk] everything comes with the package, everything comes convenient, everything comes accessible—quick, easy, you're done. So for a lot of companies that I was contacting, you know, for us, we would have been a pilot project for them so they have to weigh the pros and cons of, you know, is it worth us setting up this entire new way of processing and delivering to the company, if we're just getting one one order of this product and like a bulk size. Right.	Knowing what producer does in their practices Supporting locally grown foods Supporting small-scale farming Reduced food waste Understanding producers' values Reducing packaging waste Talking directly to producers/voicing demands

And so, that's a really interesting one in, you know, the collective. The collectiveness of systematic food change. It does take a large, like it takes many people working together and wanting this in order for that to come to light. And again, I think, at the end of the day, the most important thing when you want to create this system is really knowing and communicating with the person who's providing you with this product what you're looking for and what they're looking for and if those two values line up. Then, I think, over time, you know, building that up is what we really need to do in order to achieve a more sustainable system. You know when you're working with people that you feel really believe in what you want and what you value in, what your morals are, and how you want to purchase, right? That's huge. I think that that is an incredibly important part and it's just I mean it's just a missing link at the moment. In general, in terms of purchasing in the food industry I think that that's sort of the critical thing that I think that's a big flaw.	

Table B-2. Example of how codes from a participants' response to one question from Table B-1 were pieced into sub-themes and themes during thematic analysis, following the methodology by Damayanthi (2019).

Interview excerpts	Codes	Sub-themes	Themes
"I guess I would say the biggest one is really knowing—who you're buying it from, again, I think it matters so much." "In terms of, you know, knowing what your company is doing with any of their expired things, what your farm is doing [with] that—for me I always think it's really important to know." "And again, I think, at the end of the day, the most important thing when you want to create this [sustainable food] system is really knowing and communicating with the person who's providing you with this product what you're looking for and what they're looking for and if those two values line up."	Knowing what producer does in their practices	Direct connection with producers (i.e., minimization of middle people)	Development of a biodiverse food procurement strategy
"So for a lot of companies that I was contacting, you know, for us, we would have been a pilot project for them so they have to weigh the pros and cons of, you know, is it worth us setting up this entire new way of processing and delivering to the company, if we're just getting one one order of this product and like a bulk size." "And again, I think, at the end of the day, the most	Talking directly to producers/voicing demands		

important thing when you want to create this [sustainable food] system is really knowing and communicating with the person who's providing you with this product what you're looking for and what they're looking for and if those two values line up."			
"I think not only at the company and their goals, but what their values as a company [are], because, at the end of the day, if someone owns a farm, if they own a distributor or whatever it is like hot sauce, cereal, whatever it may be, they're doing it for a reason. And I think when you know that reason, as a purchaser, you are so much more inclined to to work with them and to build a better system for sustainable consumption of food, and I think that that is really important." "And again, I think, at the end of the day, the most important thing when you want to create this [sustainable food] system is really knowing and communicating with the person who's providing you with this product what you're looking for and what they're looking for and if those two values line up."	Understanding producers' values	Aligned values between producers and procurers	
"I really believe in local small-scale farming."	Supporting locally grown foods	Local foods	Procurement and commercialization of

“I really believe in local small-scale farming.”	Supporting small-scale farming	Foods from small-scale farms	specific foods
“I think that, you know, it's incredibly important to reduce [food] waste wherever you can.”	Reducing food waste	Reduced food waste	Waste and GHG emission reduction
“We were bulk in store and [have] bulk food—it's not the norm, right?”	Reducing packaging waste	Reduced packaging waste	

APPENDIX C: FOCUS GROUP AND INDIVIDUAL INTERVIEW DETAILS

Table C-1. Details of the focus group and individual interviews.

Primary data collection type	Participants	Date of data collection
Focus group	Representative 1 from UBC Food Services	March 11, 2022
	Representative 2 from UBC Food Services	
	Representative 3 from UBC Food Services	
	Representative 1 from the UBC SEEDS Sustainability Program	
	Representative 2 from the UBC SEEDS Sustainability Program	
	Representative 3 from the UBC SEEDS Sustainability Program	
	Representative from the UBC Botanical Garden	
	Representative from UBC C+CP	
	Representative from UBC Wellbeing	
Individual interviews	Researcher 1	March 15, 2022
	Researcher 2	March 25, 2022
	Researcher 3	March 28, 2022
	Representative from UBC Sprouts	March 21, 2022
	Representative from the UBC Climate Hub	March 22, 2022

APPENDIX D: THEMATIC ANALYSIS RESULTS

Table D-1. Thematic analysis results from responses when participants were asked what ideal biodiverse food procurement would look like in their departments and organizations. Themes are indicated in gray, while corresponding sub-themes for each theme are below.

	CFFS Action Team					
Themes/Sub-themes	**UBC Food Services (n=3)**	**UBC SEEDS Sustainability Program (n=2)**	**UBC Botanical Garden (n=1)**	**UBC C+CP (n=1)**	**UBC Wellbeing (n=1)**	**Total participants (n=8)**
Emphasis on procuring specific foods (11 mentions)						
Local foods	n=2			n=1		**37.5% (n=3)**
Seasonal foods	n=2					**25% (n=2)**
Foods from producers audited for best practices	n=1	n=1				**25% (n=2)**
Organic foods	n=1					**12.5% (n=1)**
Variety of foods	n=1					**12.5% (n=1)**
Foods from small-scale producers	n=1					**12.5% (n=1)**
Third-party certified biodiverse and resilient foods		n=1				**12.5% (n=1)**
Consumer accessibility (2 mentions)						
Accessible food pricing					n=1	**12.5% (n=1)**
Accessibility of high-quality foods (consideration of both planetary and human health)					n=1	**12.5% (n=1)**
Development of a biodiverse procurement strategy (2 mentions)						
Indicators/measurements	n=1	n=1				**25% (n=2)**
Environmental conservation/restoration (1 mention)						
Local and global food plant diversity			n=1			**12.5% (n=1)**
Farm-to-plate connections (1 mention)						
Connect individuals to producers and the food system (i.e., decentralization)		n=1				**12.5% (n=1)**

Table D-2. Thematic analysis results from responses when participants were asked what ideal biodiverse food procurement would look like at UBC, as well as at a more general standpoint. Themes are indicated in gray, while corresponding sub-themes for each theme are below. Superscript [1] indicated that there was mention of sustainable/resilient agriculture generally, but details were not specified for that statement.

Themes/Sub-themes	CFFS Action Team (n=7)	Researchers (n=3)	UBC Sprouts (n=1)	UBC Climate Hub (n=1)	Total participants (n=12)
Development of a biodiverse procurement strategy (11 mentions)					
Improved and clear definition of biodiverse and resilient food procurement	n=1	n=2			**25.0% (n=3)**
Aligned values between producers and procurers			n=1	n=1	**16.7% (n=2)**
Circular food system	n=1				**8.3% (n=1)**
Clear metrics		n=1			**8.3% (n=1)**
Variety of suppliers		n=1			**8.3% (n=1)**
Purchasing policies		n=1			**8.3% (n=1)**
Direct connection with producers (i.e., minimization of middle people)			n=1		**8.3% (n=1)**
Acknowledgement of the complexity of biodiversity				n=1	**8.3% (n=1)**
Procurement and commercialization of specific foods (10 mentions)					
Local foods	n=1	n=1	n=1		**25.0% (n=3)**
Third-party certified biodiverse and resilient foods	n=2				**16.7% (n=2)**
Seasonal foods	n=1				**8.3% (n=1)**
Organic foods	n=1				**8.3% (n=1)**
Variety of foods	n=1				**8.3% (n=1)**
Plant-based foods	n=1				**8.3% (n=1)**
Foods from small-scale farms			n=1		**8.3% (n=1)**
Consideration of sustainable/resilient agricultural producers (6 mentions)	n=1[1]				
Ecosystem preservation	n=1				**8.3% (n=1)**
Equitable plant breeding		n=1			**8.3% (n=1)**
Seed sovereignty and security		n=1			**8.3% (n=1)**
Agrobiodiversity		n=1			**8.3% (n=1)**
Functional redundancy		n=1			**8.3% (n=1)**
Waste and GHG emission reduction (5 mentions)					
Reduced food waste	n=1		n=1		**16.7% (n=2)**
Reduced packaging waste	n=1		n=1		**16.7% (n=2)**

Reduced carbon footprint	n=1				**8.3% (n=1)**
Consumer accessibility (4 mentions)					
Accessible food pricing	n=1	n=1		n=1	**25.0% (n=3)**
Accessibility of high-quality foods (consideration of both planetary and human health)	n=1				**8.3% (n=1)**
Financial support for consumers (1 mention)					
Subsidization		n=1			**8.3% (n=1)**
Financial support for procurers (1 mention)					
Acceptance of cost barriers from university administration		n=1			**8.3% (n=1)**

Table D-3. Thematic analysis results from responses when participants were asked what gaps and barriers currently exist to achieve their ideal biodiverse food procurement within their departments and organizations. Themes are indicated in gray, while corresponding sub-themes for each theme are below.

	CFFS Action Team								
Themes/Sub-themes	**UBC Food Services (n=3)**	**UBC SEEDS Sustainability Program (n=1)**	**UBC Botanical Garden (n=1)**	**UBC C+CP (n=1)**	**UBC Wellbeing (n=1)**	**Researchers (n=1)**	**UBC Sprouts (n=1)**	**UBC Climate Hub (n=1)**	**Total participants (n=10)**
Financial barriers (6 mentions)									
Perception of increased procurement costs	n=1			n=1					**20.0% (n=2)**
Food accessibility concerns for students due to perceived increased cost					n=1			n=1	**20.0% (n=2)**
Perception of increased consumer costs	n=1								**10.0% (n=1)**
Need for financial mechanisms to support and enhance biodiversity in local agriculture			n=1						**10.0% (n=1)**
Barriers to prioritize biodiverse food procurement in work (6 mentions)									
Lack of funding						n=1	n=1	n=1	**30.0% (n=3)**
Lack of time and capacity						n=1	n=1		**30.0% (n=2)**
Lack of institutional support								n=1	**10.0% (n=1)**
Challenges related to consumer demands and values (5 mentions)									
Low expected consumer demands	n=2								**20.0% (n=2)**
Lack of societal understanding of the importance of biodiversity in food			n=1				n=1		**20.0% (n=2)**
High demand for meat	n=1								**10.0% (n=1)**
Challenges with current knowledge in biodiverse food procurement (3 mentions)									
Knowledge of how and where to source biodiverse foods		n=1		n=1					**20.0% (n=2)**
Lack of emission calculation methodology in place				n=1					**10.0% (n=1)**
Challenges with procuring certain foods (2 mentions)									
Lack of access to variety of foods	n=1								**10.0% (n=1)**
Misalignment of academic season with BC's growing season for some foods	n=1								**10.0% (n=1)**
Knowledge-to-action gaps (2 mentions)									
Relationship building with other groups working within food system challenged due to COVID-19 pandemic						n=1			**10.0% (n=1)**
Challenges in understanding issues in full extent due								n=1	**10.0%**

to complexity									**(n=1)**

Table D-4. Thematic analysis results from responses when participants were asked what gaps and barriers currently exist to achieve their ideal biodiverse food procurement at UBC. Themes are indicated in gray, while corresponding sub-themes for each theme are below.

Themes/Sub-themes	CFFS Action Team (n=4)	Researchers (n=2)	UBC Climate Hub (n=1)	Total participants (n=7)
Challenges with current knowledge in biodiverse food procurement (5 mentions)				
Lack of emission calculation methodology in place	n=1			**14.3% (n=1)**
Need for whole and coherent policy and guidelines	n=1			**14.3% (n=1)**
Need for audit	n=1			**14.3% (n=1)**
Need for biodiversity assessment strategies		n=1		**14.3% (n=1)**
Need for improved general understanding of biodiversity		n=1		**14.3% (n=1)**
Financial barriers (3 mentions)				
Perception of increased procurement costs	n=1			**14.3% (n=1)**
Perception of increased consumer costs	n=1			**14.3% (n=1)**
Need for financial mechanisms to support/enhance biodiversity in local agriculture	n=1			**14.3% (n=1)**
Lack of prioritization of biodiverse food procurement (3 mentions)				
Current transiency of related research by short-term students/researchers within the institution		n=1		**14.3% (n=1)**
Need for increased funding			n=1	**14.3% (n=1)**
Need for increased institutional support			n=1	**14.3% (n=1)**
Challenges related to consumer demands and values (2 mentions)				
High demand for meat	n=1			**14.3% (n=1)**
Lack of societal understanding of the importance of biodiversity in food	n=1			**14.3% (n=1)**
Knowledge-to-action gaps (1 mention)				
Need for increased integration of research on campus		n=1		**14.3% (n=1)**
Lack of student engagement (1 mention)				
Need for increased opportunity to engage with students about biodiverse foods (e.g., in dining halls, through academic programs)		n=1		**14.3% (n=1)**
Need for systemic change (1 mention)				
Complexity and multi-layered nature of issues			n=1	**14.3% (n=1)**

Table D-5. Thematic analysis results from responses when participants were asked how biodiversity and resilience could be best supported in food procurement. Themes are indicated in gray, while corresponding sub-themes for each theme are below.

	CFFS Action Team						
Themes/Sub-themes	**UBC Food Services (n=3)**	**UBC SEEDS Sustainability Program (n=3)**	**UBC Botanical Garden (n=1)**	**UBC Wellbeing (n=1)**	**Researchers (n=1)**	**UBC Sprouts (n=1)**	**Total participants (n=10)**
Demands for individual departments and organizations							
Development of a biodiverse food procurement strategy (2 mentions)							
Creation of indicators		n=1					**10.0% (n=1)**
Consideration of pre-existing certifications		n=1					**10.0% (n=1)**
Financial support for procurement (1 mention)							
Budget incentives		n=1					**10.0% (n=1)**
Internal reflections (1 mention)							
Department- or organization-specific goal setting pertaining to biodiverse food procurement	n=1						**10.0% (n=1)**
Demands for a collaborative approach between department and organization							
Coordinated strategies (3 mentions)							
Framework for a circular food system		n=1	n=1				**20.0% (n=2)**
Strategies and targets		n=1					**10.0% (n=1)**
Demands for the university administration							
Specific and targeted support for biodiversity (6 mentions)							
Campus-wide education campaign on biodiversity	n=1						**10.0% (n=1)**
Campus-wide plant-based food education program	n=1						**10.0% (n=1)**
Creating permanent faculty positions with focus on aspects of biodiverse food procurement					n=1		**10.0% (n=1)**
Creating seed and plant breeding programs					n=1		**10.0% (n=1)**
Increased research funding for biodiverse food procurement						n=1	**10.0% (n=1)**
Support for student-led small-scale agricultural initiatives						n=1	**10.0% (n=1)**
Making public statements (3 mentions)							
Signing charter (CFFS is a current initiative)	n=1	n=2					**20.0% (n=2)**
Providing endorsements		n=1					**10.0% (n=1)**
Financial support for students (1 mention)							
Supporting adequate income for students (to meet basic needs, but also to be able to make food choices best for				n=1			**10.0% (n=1)**

themselves and for biodiversity)							

Table D-6. Thematic analysis results from responses when participants were asked what the top and most impactful actions that UBC can take to ensure a biodiverse food procurement strategy would be. Themes are indicated in gray, while corresponding sub-themes for each theme are below.

	CFFS Action Team				
Themes/Sub-themes	**UBC Food Services (n=1)**	**UBC Wellbeing (n=1)**	**Researchers (n=2)**	**UBC Sprouts (n=1)**	**Total participants (n=5)**
Further considerations in current food procurement strategy (4 mentions)					
Increased procurement from the UBC Farm produce	n=1				**20.0% (n=1)**
Abundance of plant-based food options	n=1				**20.0% (n=1)**
Increased local food sourcing				n=1	**20.0% (n=1)**
Increased support for small-scale farms				n=1	**20.0% (n=1)**
Improved biodiversity assessment strategies (4 mentions)					
Ensuring majority or all available choices are biodiverse foods and support a resilient food system to improving accessibility		n=1			**20.0% (n=1)**
Farm assessment for biodiversity			n=1		**20.0% (n=1)**
Need for clear definition of biodiversity			n=1		**20.0% (n=1)**
Need for clear metrics of biodiversity			n=1		**20.0% (n=1)**
Financial support for procurers (2 mentions)					
Acceptance of extra cost for biodiverse food procurement			n=1		**20.0% (n=1)**
Purchasing policy incentives			n=1		**20.0% (n=1)**
Financial support for students (2 mentions)					
Increased financial accessibility of biodiverse foods for students		n=1			**20.0% (n=1)**
Subsidization for students to purchase biodiverse foods			n=1		**20.0% (n=1)**
Widespread knowledge of biodiversity and biodiverse foods (1 mention)					
Campus-wide education initiatives			n=1		**20.0% (n=1)**

APPENDIX E: CERTIFICATIONS THAT PROMOTE BIODIVERSITY

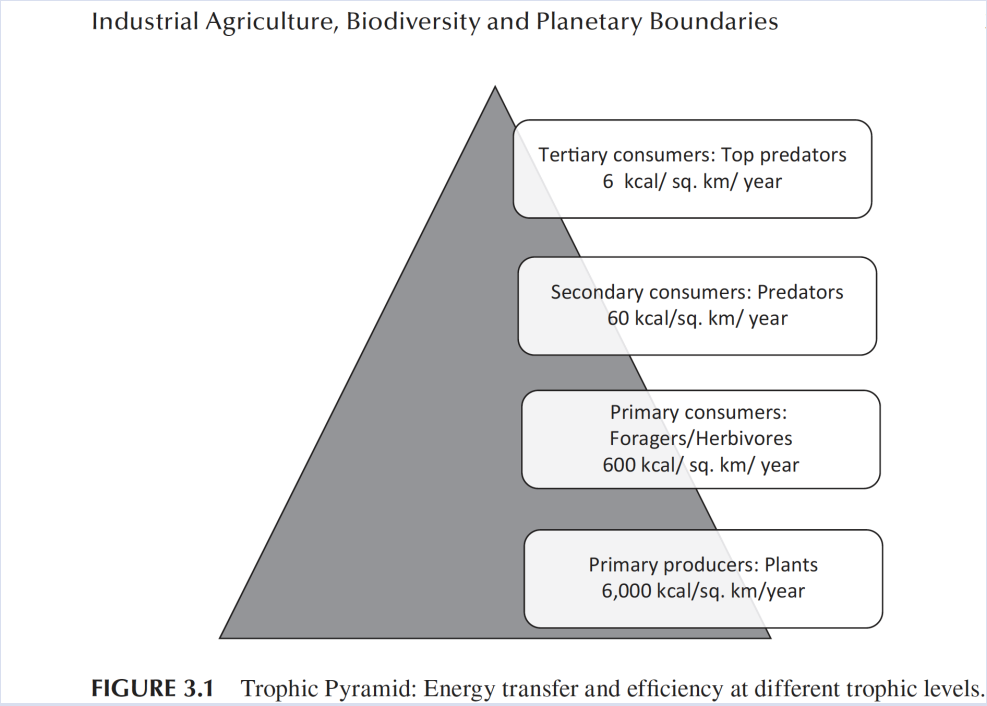
Table E-1. List of relevant food labels associated with biodiverse foods. Links to the affiliated certification website listed with the certification in the left most column. The middle column describes food certification, and the right-most column refers to the types of foods or products that typically attain these labels.

Certification	Description	Products usually included
Organic Canada	This logo can be used for products that are 95-100% organic. They include products that are not genetically engineered	Any food, seed, or animal feed
Regenerative: Ecological Outcome Verification (EOV) and Regenerative Organic Certification (ROC)	Regenerative is broadly understood as a set of tools and practices that improve soil health with each growing season (Elevitch et. al., 2018). EOV was created by the Savory Institute and ROC was created by the Rodale Institute. They both focus on soil health, biodiversity, and ecosystem function. Although it has been shown that biodiversity increases in farms practicing regenerative agriculture, it's still not central to its definition (Zabek, n.d.).	Meat and agricultural products Farms applying regenerative practices in Canada can be found here
Smithsonian Bird Friendly	This is the most scientifically backed up certification that promotes bird diversity. Its requirements include that a plantation have at least 40% canopy cover, 12-meter canopy height, and 10 different species of native trees and birds (Smithsonian National Zoo, n.d.). It has also been found that their criteria also benefits mammalian life (Claudill and Rice, 2016).	Coffee Here's a place to search for suppliers
Rainforest Alliance Certified	This certification scheme has recently been revamped after it merged with Utz, a sustainable farming certification. It guarantees that biodiversity will be protected, as well as enhance forests and build climate resilience (Ecocert, 2021). Specifically for biodiversity, it helps increase native vegetation, diversity of crops, and minimize invasive species (Kimbrough, 2020).	Agricultural products such as cocoa, coffee, tea, nuts, coconut, vegetables, cut flowers, chili, and pepper Can also include herbs, spices, and herbal tea

Forest Stewardship Certified (FSC)	FSC certification requires that estates adhere to ten principles that cover everything from conservation, workers rights, and monitoring environmental and social impact (FSC Sweden, 2017). Biodiversity constitutes one of their three pillars.	This could be for paper products such as takeout containers that are used around residence halls
Salmon-Safe BC	Salmon-Safe sites are certified to employ ecologically sustainable farming practices that enhance salmon stream habitat and water quality. While this focuses on salmon, the benefits of these farming practices reach to other species and support biodiversity in general.	Farms with many varieties of crops and animal products. Link to map of BC farms that are Salmon-Safe certified.

APPENDIX F: TROPHIC PYRAMID OF ENERGY TRANSFER

Figure F-1. The figure below depicts trophic levels, showing that there is greater availability of plants which are at the bottom of the pyramid and less caloric availability of top predators (Hawkins, 2018).



Retrieved from Hawkins, I.W. (2018). Promoting Biodiversity in Food Systems: A Textbook in Tribology (1st ed.).

CRC Press. https://doi.org/10.1201/b22084

APPENDIX G: MEMBER LIST OF THE FRASER VALLEY ORGANIC PRODUCERS ASSOCIATION

This is an association of members with organic certification including Organic Canada (COR) and BC Certified Organic Program (BCCOP). Members of interest to UBC food procurement professionals are producers, processors, and distributors. Members are listed for a wide variety of plant and animals produce/products.

FVOPA Members.pdf [Source: FVOPA, n.d.]

APPENDIX H: ENVIRONMENTAL REVIEW OF PROMISING PRACTICES FOR BIODIVERSITY IN FOOD SYSTEMS

Table H-1. Data collected from the environmental scan

Institution/municipality:	Document:	Sustainability priorities:	Promising practices for food system biodiversity:
University of Sussex	Sustainable food and agriculture policies (2021)	- Benchmarked - Local first - Healthy - Vegan Vegetarian - Animal welfare - Responsible fishing - Low carbon - Socially aware - Responsibly packaged and recycled - Extended to the supply chain	
The University of Nottingham	Sustainable Food Policy (2016)	- Seasonal - Responsible fishing - Quality meat sources - Certified produce - Recycling oil	- Develop assessment strategies to help with procurement decisions
The University of Winchester	Sustainable Food Procurement Policy (2016)	- Seasonal - Local when possible - Free range meat - Responsible fishing - Organic produce	
University of Manitoba	Food at the University of Manitoba (2015)	- Local when possible - Seasonal when possible - minimize producers that are “socially, economically, or ecologically exploitative or destructive.” - Fair trade - Social justice in the food system	- Research certifications - Create sustainable purchasing framework - Increase portion of “sustainable” products purchased
University of Victoria	University of Victoria supplier code of conduct (2019)	- Animal welfare - Social justice in the food system - Conserve biodiversity,	- UVic reserves the right to investigate suppliers compliance with the code of conduct and

		resources, and natural spaces. - Reduce emissions	potentially terminate contracts with non-compliance
University of Alberta, Augustana Campus	Sustainable Food Policy (website, n.d.)	- Local - Lower carbon footprint - Economic, social and environmental sustainability - Raise awareness of food issues - Fair trade - Protect and enhance natural habitat and biodiversity - Animal welfare - Social justice in the food system	- Monthly meals with food sourced as local as possible - When possible buy food from within 200km radius of campus
McGill University	Climate & Sustainability strategy 2020-2025 (2020)	- Local - Certified - Plant based - Circular economy - Public awareness of sustainability issues	- Increase purchases from social economy and Indigenous businesses - Educational programs for staff and faculty (Sustainability 101) - Encourage transparency between producers and procurement
City of Thunder Bay	Institutional local food procurement (2014)	- Minimizing environmental impacts - Local - Seasonal when possible	- Institutional food procurement audit

(US, 2021; UM, 2015; UW, 2016; UN, 2016; UVic, 2019; McGill University, 2020; UA, n.d.; Megens et al., 2014)