University of British Columbia

Social Ecological Economic Development Studies (SEEDS) Sustainability Program

Student Research Report

Fostering a Biodiverse Food System

Purchasing Baseline and Guidlines

Prepared by: Anna Stone, Lauren Boxold, Cougar Smith, Joshua Larsen

Prepared for: UBC Food Services

Course Code: LFS 450

University of British Columbia

Date: 26 April 2021

Prepared by: Anna Stone, Lauren Boxold, Cougar Smith, Joshua Larsen

Prepared for: UBC Food Services and UBC Seeds Sustainability Program

Course Code: LFS 450

University of British Columbia

Date: April 26, 2021

SEEDS Sustainability Program

UBC sustainability

EXECUTIVE SUMMARY

The following report was conducted by members of LFS 450 Group 3 Project Team, as a part of the UBC Food Systems Project (UBCFSP), which was initiated by the Faculty of Land and Food Systems and the Seeds Sustainability Program. Our project is titled, “Fostering a Biodiverse Food System: Purchasing Baseline and Guidelines''. Our clients are Brad Vigue and Darren Clay of UBC Food Services (UBCFS), and Laura Arrango of the SEEDS Sustainability Program.

Our project is a part of dedicated action steps taken by UBC towards advancing climate action at UBC. In response to the recent Climate Emergency Declaration, UBC realized the need of a Biodiverse Food System Action Team work on identifying and mitigating issues surrounding biodiversity in the campus food system. Our project specifically seeks to inform and align UBC’s food procurement with their values in supporting biodiversity at various scales, and accelerate a transition to a biodiverse-friendly campus.

Our main project goals are to identify gaps and opportunities for UBCFS, provide clear purchasing guidelines, and increase overall communication about biodiversity on campus. Our key project objectives are to identify exemplary practices at other universities on biodiversity and to identify opportunities to increase biodiversity in UBC’s purchasing guidelines.

This project utilized a Community-Based Action Research (CBAR) methodology in order to meet the goals and objectives of our research. Our research methods included primary and secondary data collection and utilized stakeholder interviews, analysis of past purchasing data, and a landscape scan. For our primary data collection method, we chose to conduct virtual interviews with key stakeholders, biodiversity experts, and others at UBC working on biodiversity initiatives. Our goal was to better understand UBC’s present impact on biodiversity as well as promising areas of future research. Interviews took place via Zoom and were recorded on the application, and then transcribed using the software, Otter.ai.

Our first method of secondary data collection involved analyzing past UBCFS purchasing data to identify trends. To accomplish this, we utilized Excel documents from our clients which provided in-depth food purchasing data from the years 2017-2020. Our second method of secondary data collection included a landscape scan to identify best practices that farms can implement to promote biodiversity, what other institutions were doing to improve biodiversity, find biodiverse-friendly substitutions that UBCFS could make to improve the biodiversity of their menus and to find certifications schemes that validate the efficacy of biodiversity-friendly growing practices.

Our research results showed that there are some promising purchasing practices taking place at other institutions that UBC can learn from, including utilizing certifications and eco-labels, and following the 24 Principles of Healthy, Sustainable Menus from Menus of Changed, developed by The Culinary Institute of America and Harvard T.H. Chan School of Public Health. Other results included the opportunity UBC has to purchase higher quantities of local food, as well as moving away from purchasing large amounts of meat and dairy products, which still occurs at UBC. Another result is the sheer complexity of the term biodiversity, which came up through our need to widen our landscape scan from the term “biodiversity”, to include more general terms. This provides space for increased education for the UBC community on what biodiversity is and why it is important if and when biodiversity-friendly food becomes implemented in UBCFS.

In our discussion, we explore the need to implement more plant-based, organic foods at UBC, as well as the importance of purchasing from farms that are utilizing polycultures and other complex agricultural systems. Additionally, we provide details of the efforts by other institutions to implement biodiversity-friendly guidelines.

We have split our recommendations into three categories: short term, medium term, and long term. This will help UBCFS dictate which items to focus on in the immediate future, and which items will take more time to implement. Our short term recommendations include recommendations for purchasing guidelines, promising certifications schemes, and menu substitutions that UBCFS could implement. This includes implementing certification schemes such as the Kamut certification, and substitutions such as wakame seaweed in place of traditional greens.

CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

CBAR: Community Based Action Research

FAO: Food and Agriculture Organization

UBC: University of British Columbia

UBCFS: University of British Columbia Food Services

WHO: World Health Organization

LIST OF DEFINITIONS

Agroecology: the science of applying ecological concepts and principles to manage interactions between plants, animals, humans and the environment for food security and nutrition (FAO, 2021a).

Agroforestry: a collective name for land-use systems and technologies where woody perennials (trees, shrubs, etc.) are intentionally used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence (FAO, 2015).

Monoculture: the agricultural practice of cultivating a single crop over a whole farm or area (FAO, 2021c).

Fair Trade: a trading partnership based on dialogue, transparency and respect, which seeks greater equity in international trade (Student Housing and Hospitality Services [SHHS], 2019).

Local: food that is grown, raised, caught, or processed within 250km of the Vancouver Point Grey campus (SHHS, 2019).

Ocean Wise: a Vancouver Aquarium conservation program created to help business and customers identify and purchase sustainable seafood (SHHS, 2019).

Organic agriculture: a system that relies on ecosystem management rather than external agricultural inputs (FAO, 2021b).

Perennial: a plant that typically lives for more than two years (FAO, 2021c).

Plant-based: eating pattern focused primarily on foods from plants; proportionally choosing more foods from plant sources (McManus, 2018).

Polyculture: different mix of crops, trees, animals, fish to ensure variety of food, fodder and fibre sources and complementary use of natural resources (FAO, 2021c).

Sustainability: simultaneous improvements in humans and environmental wellbeing and support of initiatives that will ensure long-term resilience of the university and its ability to serve for generations to come (SHHS, 2019).

1. INTRODUCTION

1.1 RESEARCH TOPIC

Biodiversity is defined by the Food and Agriculture Organization of the United Nations as the variety of species at the genetic, species and ecosystem levels ("Biodiversity for Food and Agriculture", 2019) In respect to this definition, biodiversity in its relation to food is, any species both domestic and non domestic that has an impact on food production and consumption directly or indirectly through contributing to ecosystem services. Currently around the globe, the vast majority of agricultural systems are reliant upon monoculture crops and livestock operations which inherently lack biodiversity, and environmentally degrading practices furthering the negative impact on biodiversity. Not only does low biodiversity eliminate many of the ecosystem services that biodiversity provides in production such as the maintenance of healthy soils, pollination, and pest control, but it makes the agricultural systems extremely vulnerable to shocks and stresses. As a result, food production is a major contributor to land use change and habitat destruction which both have a great impact on biodiversity (United Nations Environment Programme, 2021). According to the Chatham House report (2021), a consumer based paradigm shift away from products that have a dramatic negative impact on biodiversity to sustainable products that support biodiversity is a targeted outcome. Institutions will play a large role in facilitating this shift. Identification of the farm level and kitchen level practices, targeted policy, and sustainable food options that can replace current products that have a negative impact on biodiversity are essential.

1.2 RESEARCH RELEVANCE

In order to mitigate the current loss of biodiversity direct and immediate action in various levels of the current agri-food system is required. On the UBC Vancouver Campus, UBC Food Services (UBCFS) is the primary provider of meals for students on campus, with thousands of students relying on them for their daily meals. As this is an enormous amount of purchasing power, the impact UBCFS has on food procurement locally, provincially

and nationally is substantial. To ensure this purchasing power has the greatest positive impact on biodiversity through food production and procurement, focused guidelines are essential to guide UBCFS. UBCFS expressed the desire to change the options for meals that they provide by replacing dishes and foods with products that promote, rather than contribute to the loss of, biodiversity.

UBCFS can directly impact biodiversity by supporting certified businesses that apply agricultural methods that support biodiversity, purchasing products that have a positive effect on biodiversity, and informing students about biodiverse products to shift consumer demand towards biodiversity-friendly consumption. By acting on the initiatives put forth above, UBCFS can act as inspiration and an example for other institutions to do the same nationally and around the globe. In serving dishes that have a positive impact on biodiversity, the community on UBC Vancouver's campus can increase their awareness and consumption of biodiversity promoting products both on campus and beyond. By shifting sourcing to promote biodiversity, UBCFS will support business and individuals locally and around the globe that are acting on promoting biodiversity, leading to a more diverse agricultural model and more biodiverse agri-food systems.

- Describe the relevance of your project to the sustainability on campus and beyond.
  - € Describe the potential value of your research. Include anticipated value of your research to:
    - Contributing to advancing broader societal issues
    - Advancing sustainability issues, policies and practices on campus
    - Helping the community in which your research affects

1.3 PROJECT CONTEXT

- € Summarize previous work and any resources generated that are relevant to this proposal. Be sure to include background information that speaks to how your project was identified as a need.

Canada's commitments to recent international policies have allowed for recognition of the integral role biodiversity plays in sustainable food systems and in climate change adaptation. The current unsustainable global food system threatens the ecological, social, and economic systems that support human life. Biodiversity forms the basis of our food systems and provides critical ecosystem services.

UBC has taken meaningful steps towards sustainable goals and plays an integral role in advancing policies that further support biodiversity in the campus food system. Actionable steps taken by UBC include the response

to the Climate Emergency, Climate Action Plan 2030, the emerging Campus Vision 2050, and the Food Vision and Values 2019. Situated as a leader in research and sustainability, UBC recognized a need to develop a Biodiverse Food System Action Team to work on identifying and mitigating issues surrounding biodiversity in the campus food system.

The Biodiverse Food System Action Team was established to further enhance UBC's impact on sustainability with a focus on food system biodiversity, as there has been limited action in this specific area to date. This recent advancement in acknowledging the connections of biodiversity loss, climate change, and food system crises will allow for UBC to directly address biodiversity issues in the campus food system.

1.4 PROJECT PURPOSE, GOALS AND OBJECTIVES

- Identify succinctly your project purpose, goals and specific objectives. When you reference these in other sections of your report make sure you are consistent (do not use them interchangeably, e.g. the goal you cite here should be same as what you articulate later).

1.4.1 PROJECT PURPOSE

The broad intention of our research is to inform and align UBC's food procurement with their values in supporting biodiversity at various scales, and accelerate a transition to a biodiverse-friendly campus.

1.4.2 PROJECT GOALS

- To identify current gaps and opportunities that enhance the impact of UBCFS procurement and menu offerings on biodiversity.
- To provide necessary information required to inform UBCFS clear purchasing guidelines for the procurement of food that enhances biodiversity.
- To contribute information that will increase UBCFS's ability to effectively communicate with students, faculty, staff, and guests about the benefits of biodiverse-friendly dishes, and the overall impact of food production and procurement on biodiversity.

1.4.3 PROJECT OBJECTIVES

Our project objectives will advance our purpose and goals and provide our project partners with specific, tangible, and measurable actions towards achieving our desired impacts and outcomes. The list of objectives are as follows:

- To identify how other post-secondary institutions have adopted exemplary policies and guidelines towards implementing biodiverse food options.
- To analyse trademarks or certifications that UBC currently partners with (ex. Ocean Wise and Fair Trade), and identify additional partnerships and certifications that can enhance biodiversity food procurement.
- To assess the extent to which UBCFS food procurement practices can be considered biodiverse-friendly.
- To identify areas where UBCFS has the greatest opportunity to increase biodiversity in its purchasing practices through identifying alternative food products such as grains, produce and proteins.
- To provide context for organic, locally sourced, biodiverse-friendly food and create a hierarchy within these categories to inform UBCFS of the benefits or drawbacks of each option through purchasing recommendations and guidelines.

2. METHODOLOGY AND METHODS

2.1 RESEARCH METHODOLOGY

This project utilized a Community-Based Action Research (CBAR) methodology in order to meet the goals and objectives of our research (Nasrollahi, 2015; Richer, 2021). One of the main aspects of CBAR is the involvement of stakeholders who are affected by the issue being addressed. UBCFS is a key stakeholder that was involved in decision-making throughout the project, as they will be directly impacted by the anticipated outcome of changing food procurement guidelines.

Additionally, CBAR emphasizes how research is guided by cooperation and consensus. As the data we utilized is from a combination of primary and secondary sources, consideration of research ethics and best practices was necessary. Our research revolved around the needs of our primary stakeholder, UBCFS. Additional interviews of other stakeholders made up the bulk of the rest of our research. By actively involving stakeholders in the research

process, results can better reflect their priorities and desired outcomes. This required cooperation and consensus of stakeholders who are affected, as well as a wider scope that encompassed UBC's vision of being a leader in sustainability and biodiversity-friendly food systems. Through collectively determining the scope and goals of this project, the outcomes will be well directed to create solutions for addressing biodiversity in aspects of UBCFS food procurement.

2.2 RESEARCH METHODS

Our research methods, including primary and secondary data collection, utilized stakeholder interviews, analysis of past purchasing data, and a landscape scan. More details will be provided below.

2.2.1 SECONDARY DATA COLLECTION RESEARCH METHODS

For our secondary data collection, we utilized analysis of past UBCFS purchasing data, as well as a landscape scan of the literature to inform our results. For our analysis of past UBCFS purchasing data, we obtained Excel documents from our clients which provided in-depth food purchasing data from the years 2017-2020. The documents titled, "Sustainability Sourcing Report", "UBC Food Services Purchasing Data 2019", "UBC Food Services Purchasing Data 2018", and the "Feed BC Sustainability Report'' were all utilized. The most applicable documents for our group were the "Sustainability Sourcing Report" and "UBC Food Service Purchasing Data 2018". These documents laid out where UBC is purchasing its food from, including the locality of where the food was grown and then processed. They also provide data for food groups, showing the dollar amount of much of each food group UBC Food Services purchases. Additionally, the "Sustainability Sourcing Report" included figures for different notable data points, including a visual representation depicting the percentage of food purchased at UBC that is within a 250 mile radius. We have included this graph in our report, titled Figure 2. The data for the amounts of each food group that UBCFS purchases is represented in dollar amounts, so we began by using calculations to understand the percent total of each of these food groups. This allowed us to see which food groups made up the majority of purchases, and which food groups were underrepresented.

Our second method of secondary data collection included a landscape scan to identify best practices that farms can implement to promote biodiversity, what other institutions were doing to improve biodiversity, find biodiverse-friendly substitutions that UBCFS could make to improve the biodiversity of their menus and to find certifications schemes that validate the efficacy of biodiversity-friendly growing practices. To help structure our research, we created a research matrix on Excel to organize our sources and categorize them into sections which were as follows: recommendation (practice/substitution), context (societal/UBC), initiatives (community/university), and what section of the report the source would show up in (methods/results, etc). We began by conducting a broad literature review on biodiversity, including why it is important, how it shows up in the environment, and what practices, specifically agricultural practices, are doing to harm biodiversity. Once we had a firm grasp on the background context of biodiversity, we focused our attention on understanding how on-farm practices impact biodiversity. We specifically looked at reports of farmers engaging in organic and regenerative agriculture versus those engaging in conventional agriculture, to assess how each practice impacts biodiversity. We then began looking at promising practices that farms were engaging in to benefit biodiversity. Next, we focused on finding biodiverse-friendly substitutions that UBCFS could implement in their menus. We began our research by attempting to find research explicitly stating certain foods that directly address biodiversity, with little success. We then decided to expand our keyword search to include words like “sustainable”, “healthy”, and “environmentally-friendly”, which proved to be much more successful in finding foods that address these topics. This led us to sources such as “Future 50 Foods”, a report by Knorr and the World Wide Fund for Nature, which lays out 50 foods that help promote a healthier planet. We then focused on foods stated in the literature as either directly benefiting the environment they grew in, such as fixing atmospheric nitrogen as legumes do, or had a relatively low environmental impact, such as beet greens. We then focused our search into three food categories: proteins and fats, grains and cereals, and vegetables and produce. This helped us structure our recommendations into categories that can be easily utilized by the chefs creating the menus. From that list of foods we collected, we then searched for local farmers or producers in British Columbia or Canada who were producing or growing that food, to ensure that UBCFS could actually purchase this item if they

were to go through with our recommendation. That allowed us to narrow our list down significantly, and the recommendations at the end of the report is what came of the search.

Our final step in our landscape scan was to identify promising practices from other institutions to improve biodiversity in their communities. Our initial search using the term “biodiversity” resulted in almost no data. When we utilized the Campus Sustainability Hub feature through the database from The Association for the Advancement of Sustainability in Higher Education (AASHE), we were able to find some more specialized results from other university institutions implementing biodiversity-friendly practices on their campuses. However, when we expanded our search to include similar words to biodiversity, such as “sustainable”, “local”, or “environmentally-friendly”, we were much more successful in finding examples of other institutions implementing biodiversity-friendly practices.

2.2.2 PRIMARY DATA COLLECTION RESEARCH METHODS

For our primary data collection method, we chose to conduct virtual interviews with key stakeholders, biodiversity experts, and others at UBC working on biodiversity initiatives. Our goal was to better understand UBC’s present impact on biodiversity as well as promising areas of future research. Interviews took place via Zoom and were recorded on the application, and then transcribed using the software, Otter.ai. We formulated questions that would be appropriate for each of our interviewees, and included general questions that we would ask each participant at the beginning of the interviews. Our interview script and questions can be found in Appendix B, Table B1. Our sample size was 9; 3 participants were stakeholders within UBC Food Services, 1 was a biodiversity expert in the UBC community, and 5 were UBC researchers working on biodiversity-related topics. We had intended to interview a member of UBC’s purchasing team but were unable to schedule a time due to a personal conflict. We chose to interview stakeholders within UBC Food Services because we were looking for insight into the specific challenges that the UBCFS team faces when creating menus and marketing them to UBC students. We chose to interview biodiversity experts and researchers within the UBC community because we wanted their expertise as stakeholders operating within the institution of UBC about the opportunities and challenges with implementing biodiversity guidelines at UBC. We then coded our data using Microsoft Word to pull out common themes between

each interview.

2.3 METHODS OF ADMINISTRATION

We initially reached out to our interviewees via email. We found our prospective interviewees through recommendations from our clients, our personal knowledge of researchers and professors at UBC and their specific areas of expertise, as well as research into prominent stakeholders at UBC. Interviews were scheduled during the work week via Zoom for 30 minutes to 1 hour. We recorded the interviews via the record feature on Zoom, and then transcribed the interviews using the software, Otter.ai. Interviews were deemed the most effective method of primary data collection for our project as we were looking for direct input from experts in the UBC system on the challenges and opportunities that UBCFS has in implementing biodiversity-friendly policy on campus.

3. RESULTS

The current global food system is a main driver of biodiversity loss, with agricultural land expansion and intensive farming practices being the cause of major negative effects on ecosystems (Benton et al., 2021). In addition, the current global food system accounts for up to 30% of total anthropogenic greenhouse gas emissions and is a key driver of climate change. Incentive to increase food production has resulted in an overall failure to account for the impacts of food production on natural ecosystems. The current global food system is structured to increase demand, which leads to biodiversity loss through the conversion of natural and semi-natural ecosystems to agricultural land (Figure 1) and the use of unsustainable practices at the farm, landscape and global levels. Ignoring the environmental costs of the global food system has led to habitat destruction, pollution, and wildlife species loss (Figure A1).

A combination of factors in the global food system is responsible for driving biodiversity loss:

- The methods in which food is produced and used,
- The types of food produced,
- The ways in which supply, demand and price interact to drive agriculture,
- And the prioritizing of increased productivity over the sustainable use of finite resources.

Our research focused on some of these areas, with results below.

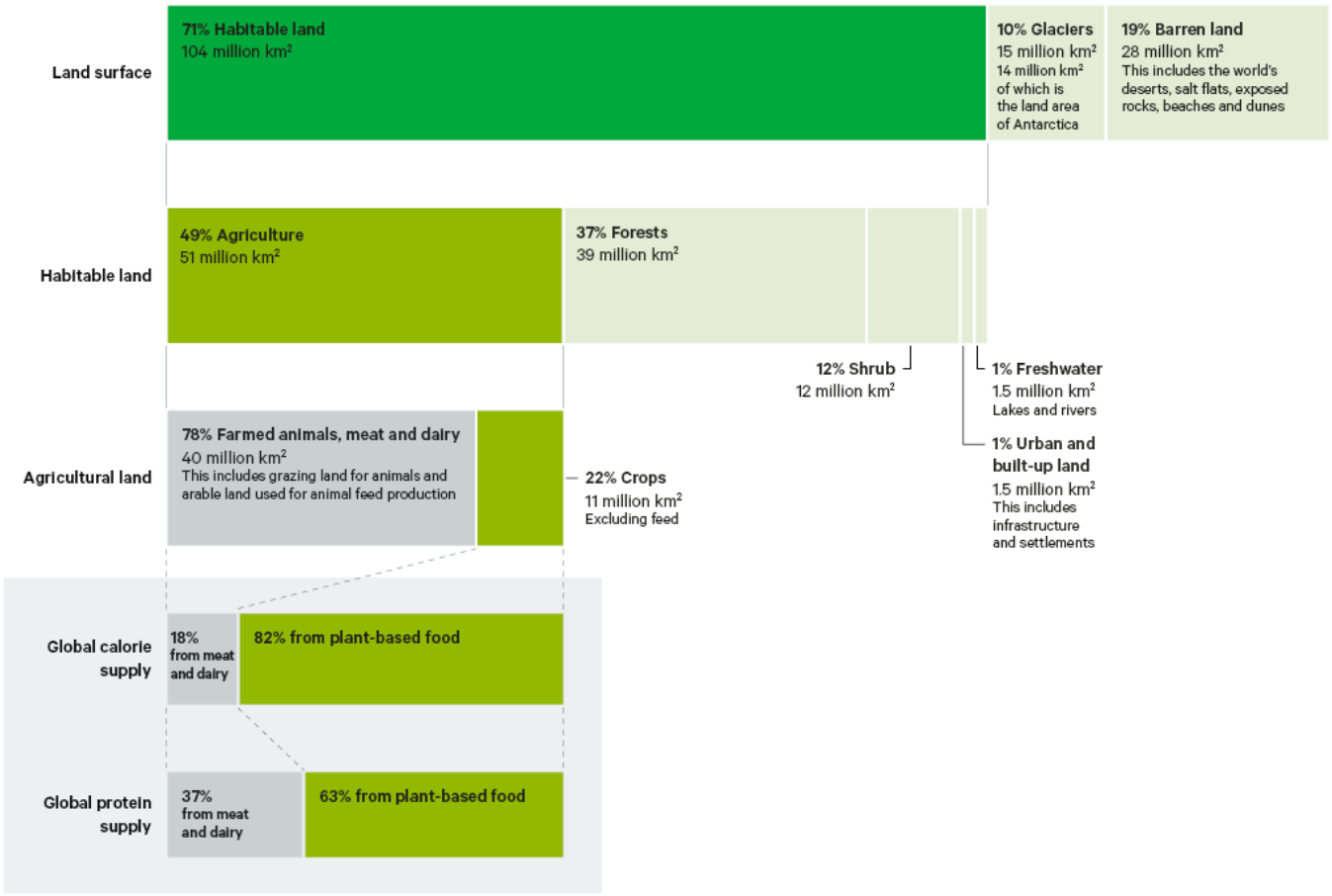

Figure 1. Breakdown of global land use, showing agriculture is a major source (Benton et al., 2021).

3.1 PURCHASING PRACTICES

Universities can utilize certifications and eco-labels to assess the impact of their food procurement. Third-party certifications and labels provide independent verification of standards of sustainability (Reynolds & Hunter, 2019). While all food label claims are regulated by the Canadian Food Inspection Agency, gaps remain in specific criteria for many production claims (ex. “Raised without antibiotics”).

The Future 50 Foods, established by the World Wildlife Fund and Knorr, a major food brand, outlines 50 foods that are currently underutilized and have the potential to reshape the future global food system (Knorr & WWF, n.d.). These foods were selected based on high nutritional value, relative environmental impact, flavor, accessibility, acceptability, and affordability, with this criteria based on the FAO’s definition of sustainable diets. A guiding principle of the methodology behind criteria for Future 50 Foods is promoting agrobiodiversity and dietary diversity.

Menus of Change, developed by The Culinary Institute of America and Harvard T.H. Chan School of Public Health, outlines 24 Principles of Healthy, Sustainable Menus (Menus of Change, n.d.). These principles provide chefs and foodservice people with menu and recipe guidance for health and sustainability.

3.1.1 ROOM FOR MORE LOCAL FOODS

There are many reasons why purchasing more local food is beneficial to biodiversity. Firstly, long distance travel of the food in our global food system has become the norm, with meals in the United States travelling 1,500 miles on average to get from farm to plate (Centre for Urban Education about Sustainable Agriculture (CUESA), 2021). This extended travel not only creates an exorbitant amount of greenhouse gas emissions from sea shipping, air travel, and trucking, but also requires high levels of post-production emissions like plastic use and chemical treatments to weather the long travel (CUESA, 2021). Purchasing locally grown food helps cut down on emissions garnered from food transportation. Additionally, localised small-scale farms have been shown to actually benefit global biodiversity, provide higher crop yields and are overall better for the environment than large-scale industrial farms (Ricciardi et al., 2021).

UBC Food Services purchasing data from 2018 shows that only just over 20% of all food purchased at UBC was grown within a 250 mile radius (Figure 2) (UBC Food Services, 2018). This shows there is a lot of room for growth for purchasing from more local farms. Our clients have expressed that this poses a challenge for a university in the Canadian context such as UBC, as the growing season falls out of line with when students are on campus, so we are advising that purchasing local produce is focused on as a recommendation for further research. We will discuss this further in the “Recommendations for Future Research” section below.

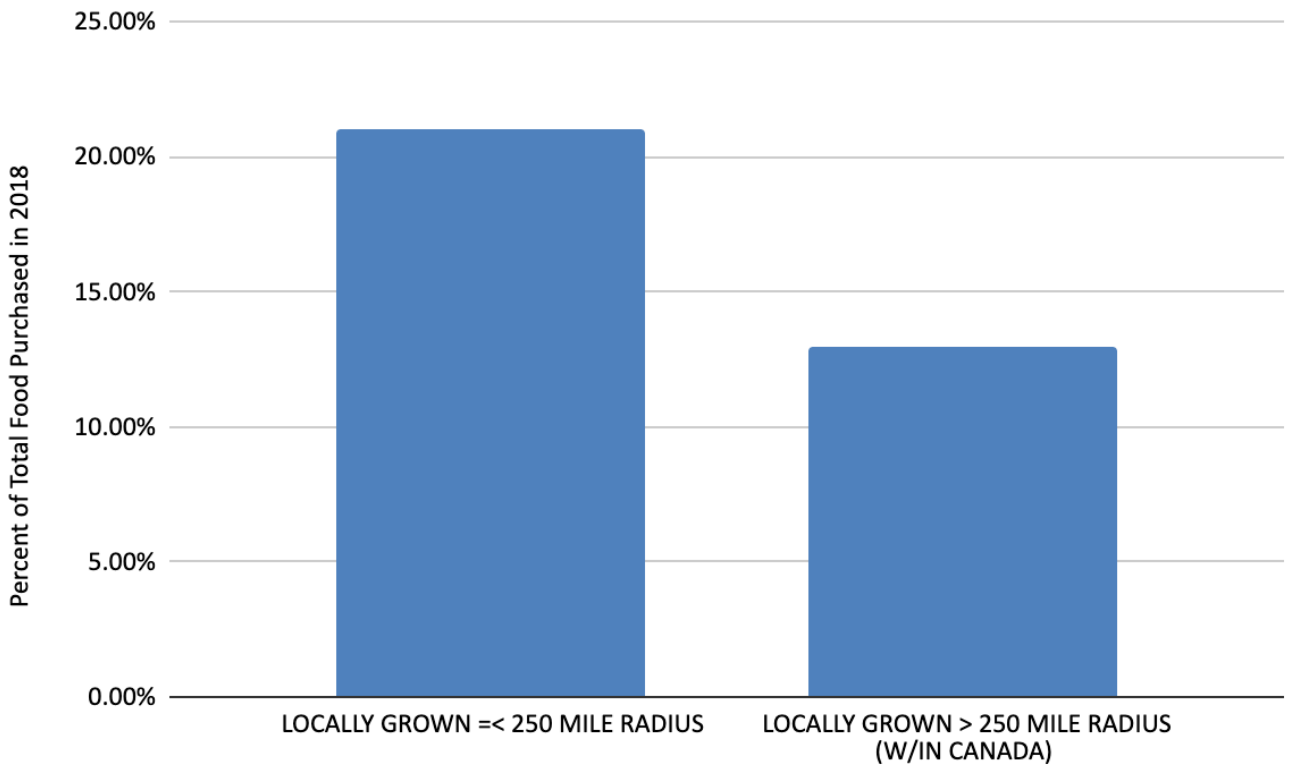

Figure 2. Percent of food purchased by UBCFS that are considered locally grown in 2018 (UBC Food Services, 2018).

3.1.2 PLANT-BASED FOODS

There is increased consensus that the most impactful way to change the current global food system in order to ensure a sustainable and healthy future is by shifting to plant-based diets (World Business Council for Sustainable Development [WBCSD], 2020). The EAT-Lancet commission was established in 2019 for an independent scientific review of how healthy diets from sustainable food systems can feed the future population within planetary boundaries (Moreau & Speight, 2019). The commission's suggested diet outlines an increased consumption of plant-based foods and fewer animal-sourced foods. Additionally, Future 50 Foods identify a shift towards plant based foods as a guiding principle (Knorr & WWF, n.d.). The report identifies beans and pulses, algae, cacti, fruit vegetables, leafy greens, mushrooms, cereals and grains, nuts and seeds, root vegetables, sprouts, and tubers as key foods that can contribute to more sustainable diets that protect the environment in the future.

3.1.3 GROWING PRACTICES

The quantity and quality of habitat for wildlife species is an important factor in supporting biodiversity through agriculture. Areas of non-productive perennial habitat are critical to maintaining and supporting on-farm biodiversity (Rallings et al., 2016). Agriculture tends to simplify landscapes, making these important and complex areas of refuge for species often inaccessible or inadequate. Expansion of agricultural land significantly negatively impacts the quality and connectivity of habitat areas. Biodiversity is highest in areas of natural and unconverted land, therefore the conservation and protection of natural ecosystems can have significant benefit on supporting biodiversity (Benton et al., 2021). Agriculture is the single largest driver of land-use change and habitat destruction, accounting for 80% globally. Setting aside land to protect natural ecosystems would have the most benefit to biodiversity across landscapes.

Specific growing practices also have a significant impact on agricultural biodiversity (Figure A2). Intensive agriculture results in various negative effects on the health and quality of soils, air, water sources, and natural ecosystems (Benton et al., 2021). Much of these negative consequences are a result of heavy use of pesticides and fertilizers, as well as the prevalence of monocultures.

3.2 THE COMPLEXITY OF BIODIVERSITY

3.2.1 HOW TO DEFINE BIODIVERSITY

Biodiversity is the backbone of all life and productivity on Earth. It provides countless essential services while simultaneously ensuring stability and providing every species the ability to uniquely adapt and thrive in the myriad of conditions found on this planet. In our literature review, it was found that the loss of biodiversity is generally considered to be equivalent in its complexity and brevity to other environmental issues, such as soil degradation and climate change. Soil degradation and climatic change are complex issues and require immediate solutions, however these environmental issues are much visible in their negative effect on humanity and as a result are more widely known (Interviews LFS 450 Group 3, 2021). Biodiversity on the other hand, although the underlying cause of many of these issues, is less visible and a result less widely addressed and acknowledged (Interviews LFS 450 Group 3, 2021).

Literature and interviews showed that how biodiversity is defined and described changes significantly based on the individual or organization. A common trend apparent in literature and from interviews of those

involved in efforts related to biodiversity, is that support of biodiversity is not a quick fix, and general awareness and understanding of biodiversity issues is lacking. Numerous institutions and initiatives attempting to mitigate the biodiversity loss are often ambiguous and missing direction. In reality, to tackle biodiversity we found that individuals and organizations need to be informed on the comments of biodiversity and how our current systems are influencing it. A complex issue requires a deep understanding of its components if one is to make significant change.

3.2.2 NEED FOR EDUCATION

The World Health Organization identifies education and awareness-raising as key to supporting biodiversity through healthy and sustainable diets (World Health Organization [WHO], 2020). There needs to be a raise in public awareness of the connections between biodiversity, nutrition and health, and the importance of biodiversity conservation in order to foster a more sustainable global food system in the future. Education, communication, and measures that influence consumer awareness, preferences, attitudes, and behaviors surrounding food, diet, and nutrition are essential for major change in the global food system to better support biodiversity.

The predominance of a few major crops and decrease in biodiversity in the global food system has also created a need for greater education. A key challenge in conserving food crops is “plant blindness,” or the public lack of awareness of plants as compared to animals (Moreau & Speight, 2019). The impacts of plant blindness can have significant repercussions on policy, funding decisions, and conservation priorities. There are also identified hurdles in promoting a shift towards plant-based diets (WBCSD, 2020). There is a need for further education and increased awareness on the impacts of animal-sourced foods, as compared to plant-based foods. To increase the demand for plant-based proteins, further encouragement of the development of and transition to food systems that promote plant proteins is needed (WBCSD, 2020). This requires stakeholders to leverage their roles in food systems to drive a shift in perception and behavior surrounding plant-based foods (WBCSD, 2020).

4. DISCUSSION

It is recognized that the key changes to the current global food system so that it better supports biodiversity are a shift towards more plant-based diets, setting aside land for natural habitats, and adoption of more sustainable

farming methods (Benton et al., 2021). Building off of findings of the literature review, key areas of impact for supporting agricultural biodiversity are identified below.

4.1 PLANT-BASED FOODS

On average at a global level, there is more food produced than humans need per capita, with as much as one third of all food produced for human consumption wasted or lost (Benton et al., 2021). Additionally, the environmental impact of food varies significantly between different products, with animal-sourced foods generally having the largest impacts. Regardless of the type of production system, animals produced for food are major emitters of greenhouse gases and produce wastes that pollute ecosystems.

A shift towards plant-based diets could significantly mitigate the negative impacts of the current global food system. Increased plant-based foods, especially in substitution for protein sources, can help balance and diversify diets, promoting good health and nutrition while also decreasing negative environmental effects (WBCSD, 2020). Additionally, shifting towards plant-based foods can reduce the amount of land required for production, allowing for reduced land-use change and habitat destruction, which are major causes of biodiversity loss. A switch from beef to beans by the entire US population could reduce land use by 692,918 km^2, with this land being available for other uses, such as ecosystem restoration (Benton et al., 2021). To achieve more sustainable food systems, it is necessary to scale up healthy plant-based proteins as alternatives to animal-based proteins (WBCSD, 2020). In order to scale-up a more diverse variety of plant-based proteins, there is a need to promote demand, which UBC is in the unique position to do.

4.2 ORGANIC FOODS

Reducing inputs is a key mechanism for reducing the impact of agriculture on biodiversity (Benton et al., 2021). Eliminating synthetic and chemical inputs and instead using ecological processes to manage agricultural systems is a key point of change towards a more positive impact by agriculture on biodiversity. In managing soil fertility, crop rotations and no-till farming can allow for viable production while reducing negative impacts of conventional farming methods. Many organic foods are produced in more complex systems, which are discussed further in depth below.

4.3 POLYCULTURES AND COMPLEX AGRICULTURAL SYSTEMS

Conventional agriculture systems rely on synthetic and chemical inputs and monoculture. This creates a vicious cycle, as the loss of biodiversity and soil fertility results in producers needing to further intensify their practices (Benton et al., 2021). Monocultures replace the heterogeneity of natural ecosystems and rely on inputs that have negative effects beyond the farm. Pesticides kill non-target species and synthetic fertilizers pollute the air and water sources. Routine ploughing and tillage disturbs the soil, killing soil organisms, releasing carbon into the atmosphere, and exposing the soil to wind and water erosion.

The impacts of farming methods on biodiversity depends on the scale and intensity of practices (Benton et al., 2021). Smaller scale and farms with smaller individual fields tend to have higher biodiversity. Many agroecological systems are inherently more diverse, as they are managed for different crops or animals and rely on crop rotations and mixed farming methods. Agroforestry and agroecological systems utilize land and natural resources in different ways than conventional systems, supporting biodiversity through maintenance of habitats and ecosystem services.

In addition to more complex agricultural systems, setting aside land for biodiversity through protecting or restoring natural habitat results in the greatest benefit for biodiversity (Benton et al., 2021). The homogenization of agricultural lands reduces or eliminates habitat areas for wildlife species and reduces the land's ability to support diverse ecosystems and viable wildlife populations. Maintaining areas of habitat for wildlife within agricultural systems can better support biodiversity, as compared to agricultural systems without available habitats for wildlife. A large number of wildlife species need access to vegetated non-production areas, such as hedgerows, to be able to complete their life stages (Rallings et al., 2016). Additionally, the connectivity of such areas is essential, as without connection wildlife can become isolated in areas where they cannot survive. On-farm habitat enhancements, such as hedgerows and riparian buffers, can improve wildlife refuges and connectivity even if agricultural land is expanded or further simplified. Overall, habitat quality decreases with agricultural expansion, however preservation of connected habitat areas can mitigate some negative impacts of agriculture on biodiversity.

4.4 SUBSTITUTIONS

The impact of foods on biodiversity varies significantly, as outlined by the need for a shift to more plant-based foods (Benton et al., 2021). The current excessive demand for foods, mainly animal-sourced foods produced in intensive systems, are damaging the environment. By shifting away from foods with significant negative impacts on the environment and biodiversity, the total demand for land would be reduced, resulting in the potential for better protection of natural and semi-natural ecosystems that are essential for supporting biodiversity. As seen from above sections, consideration of many different factors is integral when assessing the impact of food items on biodiversity.

Certification schemes can also target areas of most impact on biodiversity. Addition of more food items that are certified (ex. Ocean Wise) can have a positive impact on biodiversity, as compared to foods that are not certified. However, many sustainable practices do not fit into a label and certifications may create barriers for small farmers (Reynolds & Hunter, 2019). Many small producers practice sustainable methods, yet are not certified. As a result, universities are beginning to shift towards multiple criteria when assessing purchasing practices, such as production practices, location, and ownership in addition to certification schemes.

4.5 EXEMPLARY POLICIES AND INSTITUTIONS

4.5.1 THE GOOD FOOD CHALLENGE AND GOOD FOOD CALCULATOR

The Good Food Challenge, established by Meal Exchange and the Real Food Challenge, aims to encourage universities to uphold higher standards in local, sustainable, humane, and socially-just campus food purchasing (Good Food Calculator, n.d.). It provides institutions with a clear and definitive definition of what constitutes “Good Food”. The Good Food Calculator is an auditing tool used to track food purchases that qualify as Good Food and is guided by six pillars. In identifying Good Food, food items must meet standards in at least one pillar. The four main pillars are:

1. *Ecologically sound*: Food producers practice environmental stewardship that: conserves biodiversity; promotes ecosystem resilience; and preserves natural resources. Additionally, production practices should minimize: materials that cannot be recycled or composted; direct and indirect greenhouse gas emissions; natural resource depletion; and environmental degradation.

2. *Socially-just*: Food producers and distributors work in safe and fair conditions; receive a living wage; are ensured the right to organize and to a grievance process; and have equal opportunity for employment.
3. *Community-based*: Foods can be traced to nearby sources that are locally owned and operated.
4. *Humane*: Animals should be healthy, free from ongoing and unmitigated pain and stress, able to express natural behavior, and raised without unnecessary medication.

The fifth pillar is nested within the Community-based and Ecologically-sound pillars:

5. *Sustainable seafood*: Seafood that is locally abundant and harvested on a small scale using fishing methods that do not degrade the health of ecosystems, by fisherfolk who own and operate their vessels and are accountable to their communities.

The sixth pillar is not used to measure Good food purchasing, yet nonetheless is considered key:

6. *Food sovereignty*: The right of peoples, communities and countries to define their own agricultural, labor, fishing, food and land policies, which are ecologically, socially, economically and culturally appropriate to their unique circumstances.

The Good Food Calculator uses a stop-light system to evaluate the extent to which a food item meets standards for each pillar.

- *Green light*: Food items best represent the standard
- *Yellow light*: Food items do not represent the fullest expression of the standard
- *Red light*: Food items exhibit disqualifying criteria

4.5.2 MENUS OF CHANGE

Menus of Change established Principles of Healthy, Sustainable Menus, which outlines 24 ways in which institutions can implement change in foodservice (Menus of Change, n.d.). There are ten principles relating to menu concepts and general operations, with the remaining guidelines relating to foods and ingredients.

The principles for menu concepts and general operations that are most relevant to biodiverse-friendly food procurement are:

- *Be transparent about sourcing and preparation*: Foodservice operators can build trust by sharing information about their own practices.

- *Buy fresh and seasonal, local and global*: Creating menus around local farmers and crops can result in unbeatable flavors, and drawing on in-season produce from distant places can be key in bringing fresh flavor to the menu throughout the year.
- *Reward better agricultural practices*: The environmental cost of food is largely determined by how it is produced. Powerful strategies for supporting better farms include aligning menus to center fresh foods during the peak of the local growing season and shifting purchases towards farms with responsible practices.
- *Leverage globally inspired, plant forward culinary strategies*: The most effective way to make healthy, sustainable food choices is shifting diets towards plant-based foods. No other single decision in the professional kitchen can compare in terms of the benefits for advancing global environmental sustainability.

The principles for foods and ingredients that are most relevant to biodiverse-friendly food procurement are:

- *Think produce first*: Focus on fruits and vegetables with great diversity across meals.
- *Limit potatoes*: Chefs can limit their use by combining small portions with other, non-starchy vegetables. Healthier alternatives, such as yams, should also be considered. Salsify is a lesser-known potato substitute, and will be expanded upon below in the “Recommendations” section.
- *Move nuts and legumes to the center of the plate*: Nuts and legumes are flavorful, rich in protein, and increase satiety. Nuts and legumes are an excellent substitution for meat.
- *Serve more kinds of seafood, more often*: Focusing on a few species is depleting parts of the ocean of some species, and the benefits of eating seafood outweigh the risks so can be consumed often. Serving more types of seafood from responsibly managed sources is needed.
- *Serve less red meat, less often*: Growing enormous amounts of corn to feed animals creates food waste and negatively affects the environment. Chefs and menu developers should rethink how meat is used by featuring it in smaller, supporting roles to healthier plant-based choices.

5. RECOMMENDATIONS

5.1 RECOMMENDATIONS FOR ACTION AND IMPLEMENTATION

Describe clear actionable steps that you think your project clients and any other stakeholders deemed relevant should take based on your findings

We have split our recommendations into three categories: short term, medium term, and long term. This will help UBCFS dictate which items to focus on in the immediate future, and which items will take more time to implement.

5.1.1 SHORT TERM RECOMMENDATIONS

Our short term recommendations will discuss our recommended purchasing guidelines, certifications, and substitutions.

Purchasing Guidelines

Our recommended purchasing guidelines 1-5 are inspired by the Menus of Change Principles of Healthy, Sustainable Menus, explained above.

1.) Think produce first

2.) Limit potatoes

3.) Move nuts and legumes to the centre of the plate

4.) Serve more kinds of seafood, more often

5.) Serve less red meat, less often

Certifications

For the reasons mentioned in the results section, certification schemes are not always the best answer to achieving biodiversity in food systems. However, when purchasing from smaller farms is not available, ethical certifications are a satisfactory second option. UBCFS has already committed to purchasing from several certification schemes, including Ocean Wise. We recommend that UBCFS extends this commitment to certifications by implementing grain certification standards, which provide assurance that the crop is ethical and not genetically modified. Below are some examples of certifications for grains:

Kamut

Kamut brand khorasan wheat is an ancient grain, treasured for its taste, firm texture, and ease of digestion.

In order for khorasan wheat to be certified under the Kamut brand, farmers need to ensure that they will never hybridize or genetically modify the grain, and ensure that they are growing using organic practices. (Kamut International, 2021). Kamut khorasan wheat is primarily grown in the North Great Plains of North America, but there are several BC farmers growing it more locally as well. Below we have included a list of the farmers and purchasing companies providing Kamut to BC:

1.) Salt Spring Seeds - Salt Spring Island, BC
2.) True Grain Bread (Purchasing company)
3.) Fieldstone Organics (Purchasing company)

Other Grains

Besides Kamut, there are a host of other BC grown, organically certified grains with high quality standards (True Grain, 2019), including:

1.) Red Fife Wheat
2.) Spelt
3.) Emmer
4.) Rye

Substitutions

We have split our substitutions up into three categories that represent the three main components of any meal: proteins/fats, grains/cereals, and vegetables/produce.

Proteins/Fats

1.) Nuts instead of meat products
    a.) Nuts are a great source of protein, fibre and fat. They provide heterogeneity to the landscape, increasing overall farm biodiversity. They are perennial, which eliminates the need for tilling practices which harm biodiversity, and they contribute to negative carbon emissions by sequestering carbon (Ritchie, 2021). Nuts produce 2.4kg of CO_2 equivalents for every 100g, whereas beef produces an average of 25kg of CO_2 equivalents (Ritchie, 2021).
    b.) Examples

i.) Walnuts

(1) Great source of omega 3 fatty acid and vitamin E (Knorr & WWF, 2019)

ii.) Chestnuts

(1) Chestnuts have a relatively high nutrient density and require a smaller water footprint compared to other nuts (Sokolow, 2019).

2.) Legumes instead of meat products

a.) Legumes are very beneficial to biodiversity because they fix atmospheric nitrogen, release high-quality organic matter into the soil, and facilitate soil nutrient circulation and water retention (Stagnari et al., 2017). Examples:

i.) Adzuki beans

ii.) Broad beans

iii.) Cowpeas

iv.) Lentils

v.) Mung beans

Grain/Cereals

1.) Utilizing more ancient grains instead of traditional wheat (Knorr & WWF, 2019; True Grain, 2019). Examples:

a.) Kamut Certification

b.) Red Fife Wheat

c.) Spelt

d.) Emmer

e.) Rye

f.) Amaranth

g.) Teff

Vegetables/Produce

1.) Beet greens

a.) Beet greens are the most nutritious part of the beet plant, containing high levels of magnesium and potassium (Knorr & WWF, 2019).

b.) Beet greens can reduce food waste, which is a key threat to worldwide biodiversity (Benton et al., 2019). In addition to reducing food waste, they are also more cost-sensitive, because through purchasing a beet, UBCFS can utilize both the root and the leaves.

c.) They can be used as auxiliary greens, which are greens mixed in with other greens, such as mustard greens. They are also delicious in stir fries, soups and sandwiches.

d.) Beet greens could easily replace other greens like spinach, romaine or swiss chard.

2.) Wakame seaweed - also called Winged Kelp

a.) Wakame seaweed is rich in protein, dietary fibers, vitamins, and antioxidants (Prabhasankar et al., 2009). It is also one of the few plant-based sources of omega 3 fatty acid, which is found almost exclusively in fish (Knorr & WWF, 2019).

b.) Cultivating seaweeds is seen as a more sustainable practice than typical land-based farming because it requires no fresh water, fertilizers or land-use (Tiwari & Troy, 2015).

c.) Sustainably harvested around the BC coast. Companies include:

i.) BC Kelp (Prince Rupert)

ii.) Dakini Tidal Wilds (Vancouver Island)

iii.) Cascadia Seaweed (Vancouver Island)

3.) Figs

a.) Figs can be utilized many ways, such as in dishes as a natural sweetener, baked into pies and desserts, tossed with salads, or made into jam.

b.) Fig trees provide critical habitat for a multitude of fauna, including birds, squirrels, reptiles, and monkeys, and are known as a keystone species for the critical role they play in sustaining ecosystems (Shanahan, 2017)

4.) Salsify

a.) Salsify is a parsnip-like root vegetable, and can be boiled, mashed, or baked (Granica et al., 2015).

b.) Salsify is commonly used as a potato substitute, which as explained above, will help benefit biodiversity.

c.) Salsify comes in white or black varieties, and is high in fibre, vitamin E and iron.

5.1.2 MEDIUM TERM RECOMMENDATIONS

Our medium term recommendation is for UBC Food Services to focus on purchasing from farms with more sustainable and biodiversity-friendly practices. As mentioned in section 4.3, on-farm practices, such as polyculture implementation or organic agricultural practices, have significant impact on biodiversity. For most foods, the section of the supply chain that results in the highest greenhouse gas (GHG) emissions are on-farm practices (Ritchie and Roser, 2020). This is particularly true for those foods with relatively high GHG emissions, such as beef and dairy. On-farm practices that result in high GHG emissions include applications of fertilizers or the use of monocultures. In order for UBC Food Services to ensure that it is purchasing from farms that are mitigating their effects on biodiversity, and implementing sustainable practices, we recommend a set of criteria be established that farms need to pass in order to sell to UBC Food Services. Items on the criteria could be anything from polycultures and organic practices as discussed in previous sections in this report, to intentional GHG mitigation practices. Another way to ensure farms are meeting certain standards would be to develop a certification scheme that farms must qualify for. This certification could be implemented similarly to the way that Ocean Wise has been at UBC, where farms must prove that they meet the designated criteria before their products can be sold at UBC.

We acknowledge that the process of ensuring that farms are meeting certain standards through a certification scheme or otherwise will be a lengthy process.f That is why we have put this recommendation as a medium term recommendation, to allow for proper time to implement. Although this is a recommendation that wouldn’t have a large impact in the short-term, it would provide UBC with the opportunity to ensure that it is purchasing food that provides the most biodiversity benefits possible.

5.1.3 LONG TERM RECOMMENDATIONS

Our long term recommendation is to foster a consumer-based shift towards more biodiversity-friendly

foods through increased education and awareness about the impacts of one's food choices on biodiversity. Biodiversity is a complex issue and there remains a lack of general public understanding of the severity of the issue of biodiversity loss, as well as the individual power to mitigate the impact on biodiversity through food choices. We are recommending UBCFS to develop an educational program to address this gap in knowledge and to use its unique position as a food provider for thousands of individuals each day to leverage a consumer-based shift towards prioritizing biodiversity-friendly foods.

One potential way to encourage this shift is to build on the already existing menu icons used by UBCFS. Currently, UBCFS identifies vegetarian, vegan, made without gluten, Ocean Wise, and halal on residence dining hall menus. Recognizing the potential for information overload, we are suggesting creating a clear icon that can be used to identify menu items that contain biodiversity-friendly ingredients and/or are sourced from farms using biodiversity-friendly practices. Having a menu icon for biodiversity-friendly foods could help normalize choosing such foods, much like how plant-based foods have become normalized in many menus.

A second method we are recommending to foster a consumer-based shift towards more biodiversity-friendly foods is to establish an educational month campaign, similar to the already established Ocean Wise month in February. By centering biodiversity-friendly foods in the dialogue of UBCFS for a month and engaging students through various activities, UBCFS can increase awareness surrounding biodiversity-friendly foods and the individual power of consumers.

We recognize that the two potential methods for increasing education around biodiversity-friendly foods will not alone be successful in creating major consumer-based change. A consumer-based shift towards supporting biodiversity through food choices requires ongoing education and intentional choices. However, as UBC strives to create a more biodiverse-friendly campus community, such actions create a basis for greater change. These ideas are in no way exhaustive, and serve as a baseline for action towards further education of consumers.

5.2 RECOMMENDATIONS FOR FUTURE RESEARCH

One key area for future research is identifying ways in which UBCFS can increase their purchasing of local foods during the winter when campus demand is highest yet climate limits viable crops. One potential method to continue local food purchasing during winter would be to further explore food items that are underutilized.

Research into sources of winter crops that are currently not utilized in menus could allow for UBCFS to meet their goals of buying more local foods and supporting greater biodiversity by purchasing novel ingredients. This research could include many different avenues, including:

- Methods of food preservation: utilization of technologies such as freezing or canning to extend the life of out-of-season foods into the winter to meet consumer demand
- Identification of growers and food producers: potential partnerships with growers and food producers using crop rotations or specializing in winter crops
- How to expand menu ingredients: identification of areas of opportunity for additional substitutions for in-season winter crops instead of out-of-season ingredients

A second area for future research is identifying additional ways for education and customer engagement. This area of research will help UBCFS meet the long term recommendation of fostering a consumer-based shift towards a preference for biodiversity-friendly foods and will continue to shift UBC towards a more biodiversity-friendly campus. Research could include:

- Consumer feedback: engagement with consumers at residence dining halls after implementation of the short term recommendation of various sourcing and menu changes to gauge satisfaction and awareness
- Emerging exemplary policies and institutions: further identification of emerging exemplary policies and institutions to identify further opportunities for improvement in UBCFS's support of biodiversity

6. CONCLUSION

To mitigate the loss of biodiversity, humanity needs to create a system in which biodiversity is a priority. In light of the challenges we currently face from population growth, food insecurity, and climate change, this will be one the greatest challenges we face as a society. In order to do so, and to be able to inhabit this planet at the scale we are, we need sustainable agrifood systems. Over the course of our study, this much was clear, the loss of biodiversity is an extremely complex issue and requires a complex response. It requires a rapid and massive transition away from the practices and products that current literature has shown to be detrimental to biodiversity in the agricultural, political, and societal settings.

In respect to agriculture, our dependence on monocultures which replace the heterogeneity of natural ecosystems and rely on toxic anthropogenic inputs has brought havoc on biodiversity. Instead, farms that utilize practices such as polycultures and complex agricultural systems which tend to support biodiversity by utilizing the land and natural resources in ways that support biodiversity through maintenance of habitats and ecosystem services, need to be prioritized and supported. Organic practices and techniques which utilize ecosystem services instead of synthetic inputs and are instead reliant upon ecologically complex systems are promising. Certification schemes are a very useful method that can aid in supporting farms that utilize practices such as those mentioned above. Universities can shift towards using multiple criteria when assessing purchasing practices, such as examining practices and verifying certification schemes of the supplier.

Policy and programmes supported by the information found within initiatives such as The Good Food Challenge, established by Meal Exchange and the Menus of Change can provide principles and methods for institutions and organizations to utilize as guidelines and act as inspiration. Initiatives such as these can encourage universities to uphold higher standards in local, sustainable, humane, and socially-just campus food purchasing. Policy and programmes can also enable institutions to directly contribute to restoring natural habitat which was shown to have the greatest benefit for biodiversity.

Through our review of literature and interviews, a consumer based paradigm shift was identified as essential. In order to facilitate a transition to a more sustainable diet that supports biodiversity, various actions were deemed necessary. Primarily this consumer based shift requires an immediate shift towards plant-based diets which significantly reduce an individual's impact on biodiversity. In combination with an immediate shift to a plant based diet, substituting foods that have a large negative impact on biodiversity with foods that better support biodiversity is essential. Substitutions of food groups provided in our recommendations such as replacing common wheat with ancient grains like amaranth and teff could potentially contribute to an immediate action to mitigate biodiversity loss by individuals and institutions.

This transition does require massive changes at all levels in order to succeed. The micro scale, individuals willingly reshaping their behaviour and perspectives in the short term, driving the market and politicians to change. The meso scale and medium term, farmers and organizations changing the harmful techniques that

humanity has relied upon for generations. Finally, the macro scale where large institutions enact ambitious policy and commitments for long term change.

In light of what is required, UBCFS does truly have a tremendous capacity to enact impactful change. Currently, UBCFS has taken large strides and significant impacts are visible, which should be shared and utilized to motivate other institutions to do the same. However, to best mitigate the loss of biodiversity and to even support its regeneration, persistence is required. A combination of all the changes to policy, practice and perspective we have mentioned need to be enacted with stern timelines created and accountability ensured. There is no quick fix to the loss of biodiversity as it does stem from inherited societal and economic frameworks that have been in place for generations, but with immediate action directed to each of the required scales, change is feasible, it is up to UBCFS to lead the way.

REFERENCES

Benton, T., Bieg, C., Harwatt, H., Pudasaini, R., & Wellesley, L. (2021). Food system impacts on biodiversity loss. Chatham House. Retrieved April 22, 2021, from https://www.chathamhouse.org/2021/02/food-system-impacts-biodiversity-loss/04-recommendations-action-2021

Food and Agriculture Organization of the United Nations. (2015). Agroforestry: Definition. *Food and Agriculture*

Organization of the United Nations. http://www.fao.org/forestry/agroforestry/80338/en/#:~:text=Agroforestry%20is%20a%20collective%20name,spatial%20arrangement%20or%20temporal%20sequence.

Food and Agriculture Organization of the United Nations. (2021a). Agroecology knowledge hub: Practices. *Food and Agriculture Organization of the United Nations.* http://www.fao.org/agroecology/knowledge/practices/en/

Food and Agriculture Organization of the United Nations. (2021b). What is organic agriculture? *Food and Agriculture Organization of the United Nations.* http://www.fao.org/organicag/oa-faq/oa-faq1/en/

Food and Agriculture Organization of the United Nations. (2021c). FAO term portal. *Food and Agriculture Organization of the United Nations.* http://www.fao.org/faoterm/en/

Good Food Calculator. (n.d.). *About the calculator*. Good Food Challenge. https://calculator.mealexchange.com/help/aboutthecalculator

Granica, S., Lohwasser, U., Jöhrer, K., & Zidorn, C. (2015). Qualitative and quantitative analyses of secondary metabolites in aerial and subaerial of Scorzonera hispanica L. (black salsify). Food chemistry, 173, 321–331. https://doi.org/10.1016/j.foodchem.2014.10.006

Kamut International. (2021). The Grain. *Kamut International Ltd.* https://www.kamut.com/en/discover/the-grain

Knorr & WWF. (n.d.). Future 50 foods. https://www.wwf.org.uk/sites/default/files/2019-02/Knorr_Future_50_Report_FINAL_Online.pdf

McManus, K.D. (2018). What is a plant-based diet and why should you try it? *Harvard Health Publishing*. https://www.health.harvard.edu/blog/what-is-a-plant-based-diet-and-why-should-you-try-it-2018092614760

Menus of Change. (n.d.). *Principles of healthy, sustainable menus.* Menus of Change. https://www.ciaprochef.com/MOCPrinciplesReport/

Moreau, T. & Speight, D. (2019). Cooking up diverse diets: Advancing biodiversity in food and agriculture through collaborations with chefs. *Crop Science, 59*(6), 2381-2386. https://doi.org/10.2135/cropsci2019.06.0355

Nasrollahi, M.A. (2015). A closer look at using Stringer's action research model in improving students' learning. *International Journal of Current Research, 7*(7), 18663-18668.

Prabhasankar, P., Ganesan, P., Bhaskar, N., Hirose, A., Stephen, N., Gowda, L. R., Hosokawa, M., & Miyashita, K. (2009). Edible Japanese seaweed, wakame (Undaria pinnatifida) as an ingredient in pasta: Chemical, functional and structural evaluation. Food Chemistry, 115(2), 501–508. https://doi.org/10.1016/j.foodchem.2008.12.047

Rallings, A., Smuckler, S., & Mullinix, K. (2016). Wildlife habitat and the impact of agriculture on biodiversity in a regionalized food system. *Institute for Sustainable Food Systems.* https://www.kpu.ca/sites/default/files/ISFS/SWBC%20project%20research%20brief_Biodiversity_Final.pdf

Reynolds, J. & Hunter, B. (2019). From contracts to culture: Exploring how to leverage local, sustainable food purchasing by institutions for food systems change. *Canadian Food Studies, 6*(1), 8-21. https://canadianfoodstudies.uwaterloo.ca/index.php/cfs/article/view/285/308

Richer, L. (2021). *Research and project management*. Personal collection of L. Richer, University of British Columbia, Vancouver, BC.

Ritchie, H., & Roser, M. (2020). Environmental impacts of food production. Our World in Data. Retrieved March 30, 2021, https://ourworldindata.org/environmental-impacts-of-food

Shanahan, M. (2017). The Tree That Shaped Human History. BBC. http://www.bbc.com/earth/story/20170116-the-tree-that-shaped-human-history

Sokolow, J., Kennedy, G., & Attwood, S. (2019). Managing Crop tradeoffs: A methodology for comparing the water footprint and nutrient density of crops for food system sustainability. Journal of Cleaner Production, 225, 913–927. https://doi.org/10.1016/j.jclepro.2019.03.056

Stagnari, F., Maggio, A., Galieni, A. et al. Multiple benefits of legumes for agriculture sustainability: an overview. Chem. Biol. Technol. Agric. 4, 2 (2017). https://doi.org/10.1186/s40538-016-0085-1

Student Housing and Hospitality Services. (2019). Food vision & values. The University of British Columbia. https://food.ok.ubc.ca/wp-content/uploads/2019/06/Food-vision_values.2019.pdf

Tiwari, B. K., & Troy, D. J. (2015). Chapter 1—Seaweed sustainability – food and nonfood applications. In B. K. Tiwari & D. J. Troy (Eds.), Seaweed Sustainability (pp. 1–6). Academic Press. https://doi.org/10.1016/B978-0-12-418697-2.00001-5

True Grain. (2019). *Farming.* True Grain Bread Ltd. http://www.truegrain.ca/farming/

World Business Council for Sustainable Development. (2020). Plant proteins: A key lever to accelerate food system

transformation. World Business Council for Sustainable Development. Retrieved April 22, 2021, from https://www.wbcsd.org/contentwbc/download/8268/128367/1

World Health Organization. (2020). Guidance on mainstreaming biodiversity for nutrition and health. *World Health*

Organization. https://cdn.who.int/media/docs/default-source/climate-change/mainstreaming-biodiversity-for-nutrition-and-health12d76606-f87e-4857-9264-dd2b2924186a.pdf?sfvrsn=afd00782_1&download=true

APPENDICES

APPENDIX A: ADDITIONAL FIGURES

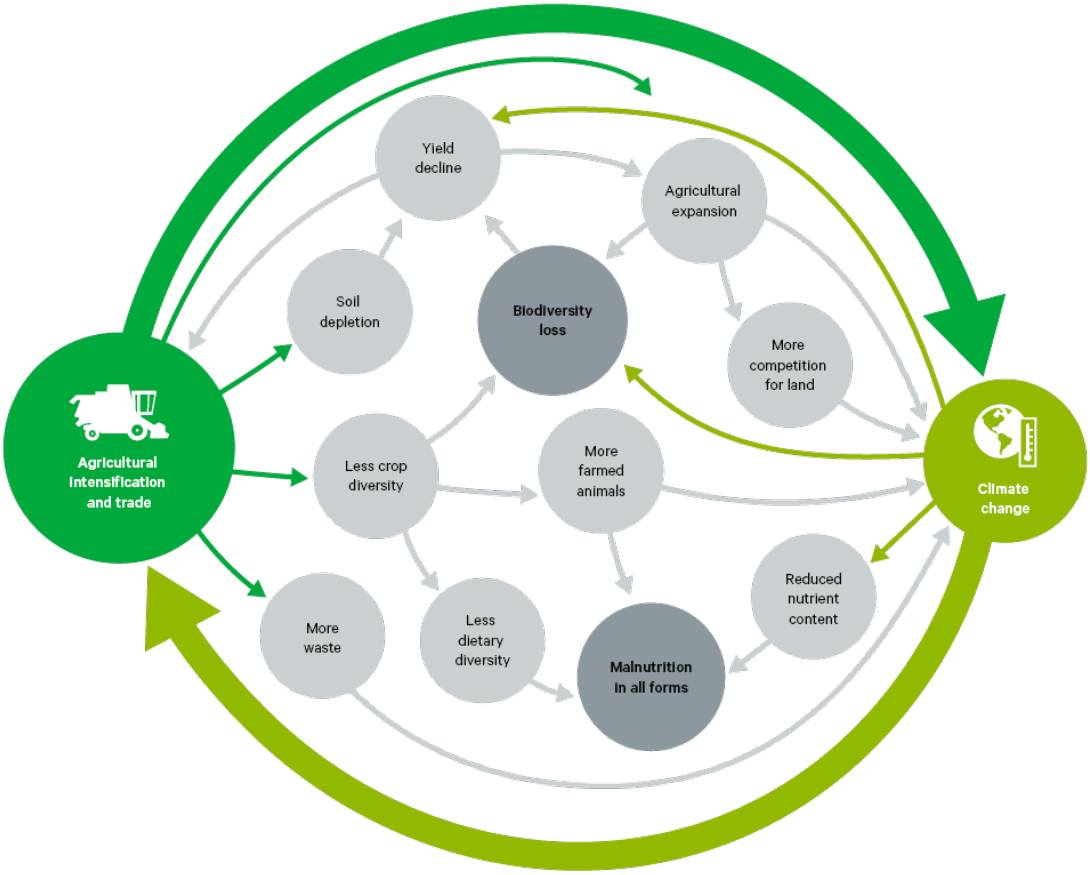

Figure A1. Impacts of agriculture intensification and trade, with climate change, showing significant effect on biodiversity loss (Benton et al., 2021).

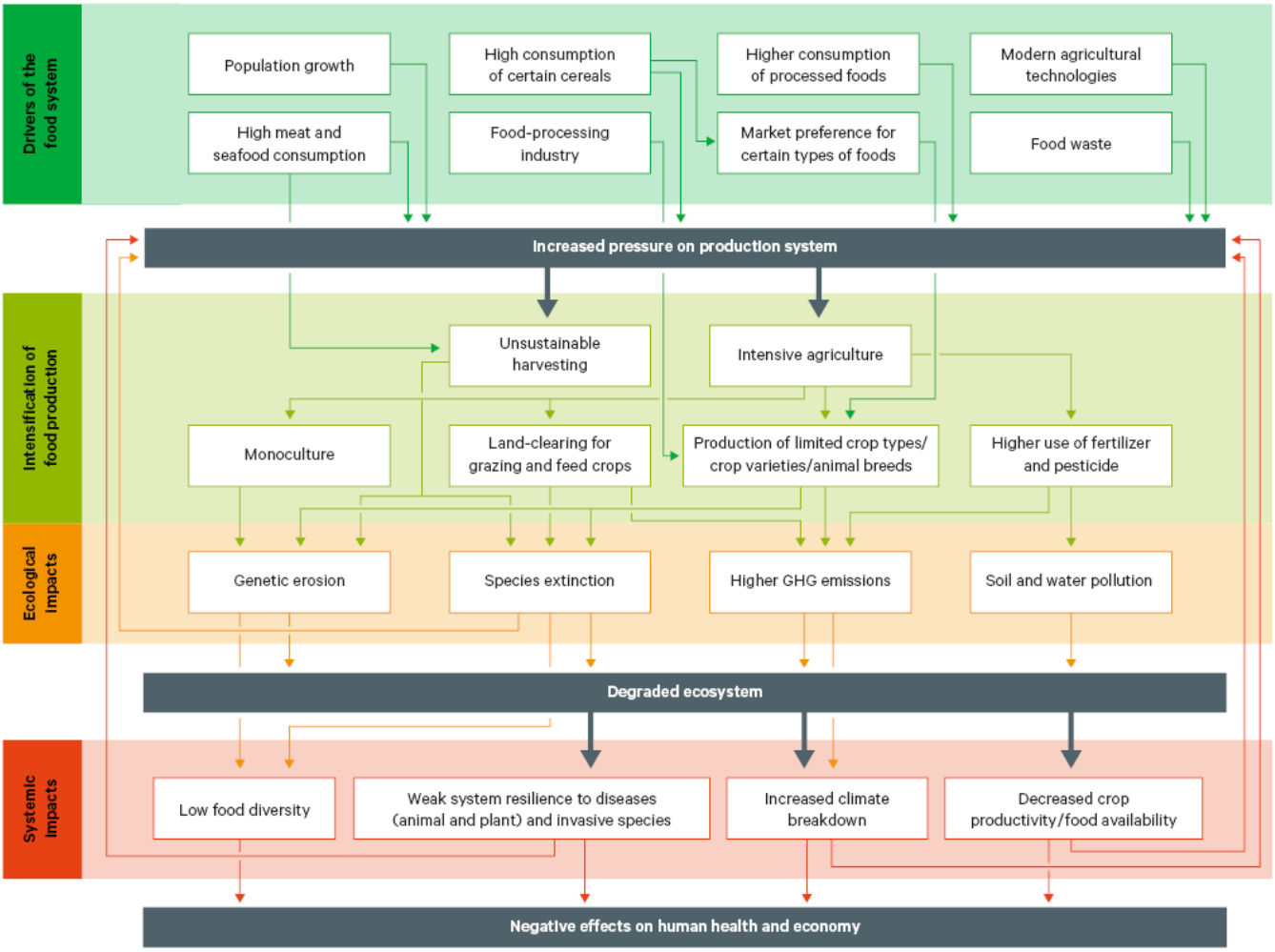

Figure A2. Visual representation of the structure of the food system and resulting ecological and systemic impacts (Benton et al., 2021).

APPENDIX B: INTERVIEW SCRIPT

Table B1: Interview script and questions used during primary research, with not all questions used and wording slightly differing based on the individual interviewer.

Welcome/Purpose/Timing:

- Thank you for taking the time to participate in this research today. My name is “insert name here” and I am working on this project for LFS 450 which is a course at UBC where we work on a project for a community partner to improve sustainability initiatives on campus.
- We will create biodiversity-friendly purchasing guidelines here at UBC based on your feedback and response. This will immediately impact the sustainability of food made on campus and will provide a framework for other universities and institutions to follow.
- We will be asking you prepared questions to help us better understand the UBC food system and biodiversity at large.
- This interview can take as much time as you have available today, do you have a time that you’ll need to wrap up by?
- If you need to get into contact with use after the interview please feel

free to reach out to us via the email we first contacted you with.
- Do you have any questions for us before we get started?

General Questions:
- What is your position at UBC? OR Describe your biodiversity initiative.
- How would you define biodiversity?
- Are you currently encouraged to think about the impacts of your work on biodiversity?
- What was your previous background before coming to UBC?

Role Specific Questions:

Chefs	**Individuals Working with Biodiversity Initiatives**	**Biodiversity Researchers**

• From your knowledge of student food interests/ tastes, is there a market for more biodiverse foods in residence dining halls?
• What food categories have you seen growing interest in that could contribute to biodiversity?
• What are the barriers for incorporating new, biodiverse ingredients into menu items?
• What do you imagine the best method to communicate information to students regarding the
	• What makes you excited to work on improving biodiversity if at all?
	• Is biodiversity important to you? If so why or why not?
	• Have you had challenges with your project? If so, what has been the greatest challenge?
	• Have you had successes with your project? If so, what has been?
	• What role do institutions play, if any, in supporting biodiversity?
	• How do you continue to incentivise and advocate for biodiversity initiatives when the current framework isn't conducive to these initiatives?
		• Is biodiversity important to humans? If so why?
		• What do you see, if anything, as the greatest lever for reducing biodiversity loss?
		  ○ Globally
		  ○ Locally at UBC
		• What could farms do to increase biodiversity?
		• What could chefs do to increase biodiversity?
		• What role do institutions play, if any, in supporting biodiversity?
		• Are the current policy frameworks conducive to the incentivisation of biodiversity initiatives? Explain?
		• How do you feel your research in this field of study has been received (institution/scientific community/ government)?
		• As a researcher in this field where do you find your efforts for addressing these issues are being limited the most? (support of/reception of etc.)

biodiversity of their food on campus is? ex] social media, playcards in the dining halls, youtube videos, Nutrislice app, etc. • How do you envision incorporating biodiverse foods/ingredients into menu items? Ex] single ingredient substitutions, or whole new meals • How are you learning about these topics of sustainability? Where are you getting your information from?		

Follow up Questions:

- Is there anyone you know of working with biodiversity who you would love to interview?
- Are there any biodiversity initiatives that you know about / that excite you?
- Is there anyone who you think we should talk to?

Closing Questions:

- Is there anything that we haven't discussed that you feel would be beneficial for us to know? / Thanks for your time!
- Is there anything else that we didn't ask you that you wish we would have?

Next Steps:

1. We will follow up with you once we have the results from our research