PRINCIPLES AND PROCESSES FOR FOOD SOVEREIGNTY: AN EXAMINATION OF THE BLUEBERRY SECTOR IN BRITISH COLUMBIA

by

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Abstract

As a concept that has increasingly been invoked in discussions of social and political food systems dynamics, food sovereignty calls for the holistic consideration of human and ecological aspects of agricultural systems with a focus on power and political dynamics. We investigated an export-oriented agricultural production system as a case study to understand how and to what extent food sovereignty principles can be enacted in the context of agriculture in the Global North. The blueberry industry in British Columbia, Canada, is socially and economically significant within a regional food system, and is globally integrated through export and trade. This study employs the framework of food sovereignty by drawing on principles of equity, empowerment and ecology as a methodological tool for assessing food systems, and examines how local producers in the BC blueberry industry are responding to pressures, constraints and opportunities in the global food system. I identified and operationalized key principles and processes for food sovereignty in the form of indicators. I conducted 33 structured interviews with blueberry growers representing a range of scales and modes of production. Significant themes and dynamics related to food sovereignty discussed by growers were: high demands for seasonal labour leading to mechanization; blueberry production as a means to attain a farming lifestyle while supplementing with significant off-farm income; and a perceived lack of power among growers relative to other actors in the food system. Participants expressed reduced decision autonomy through resource constraints and economic pressures. The combination of economic forces and social dynamics that have most growers locked into an industrial production cycle represent a barrier to achieving food sovereignty principles. On the other hand, there were several important institutions in the industry that support and empower growers through democratic participation opportunities, knowledge translation, and field expertise. A

significant re-orientation of food systems governance and policy combined with economic re-structuring and social empowerment mechanisms would be needed to approach the realization of food sovereignty principles in the BC food system.

Preface

This work was conceptualized as part of two larger, collaborative research projects. The first is a SSHRC project led by Dr. Hannah Wittman entitled "Measuring Progress Towards Food Sovereignty: The effect of mediated markets on re-defining socio-ecological value in the food system", focusing on developing indicators of food sovereignty that can be used across geographic and social contexts. The second is CIHR funded project entitled "Think, Eat and Grow Green Globally", which involved a cross-national comparison of banana production in Ecuador and blueberry production in British Columbia, examining the intersection of health equity and food sovereignty under the leadership of Drs. Jerry Spiegel, Hannah Wittman, and Jaime Breilh of the Universidad Andina Simón Bolívar. This thesis project was conceptualized as a complement to the investigation of export-oriented banana supply chains in Ecuador, and the suite of indicators used as a data collection tool in the blueberry sector was co-developed with this research team and our partners in Ecuador.

I participated in research design under the supervision of Drs. Wittman and Speigel. I designed and conducted the field interviews, performed the data analysis, and prepared the thesis manuscript. I had assistance from a volunteer, Audrey Tung, for the transcription of four interviews, and am very grateful to her for her help. I performed the remaining transcriptions.

The fieldwork reported in Chapters 5 was approved by the UBC Behavioural Research Ethics Board (approval number H15-00134).

Table of Contents

List of Tables

List of Figures

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To Grandpa Jake

Chapter 1. Introduction

Agriculture is at the centre of some of the biggest challenges facing society in the 21st century. In addition to being a significant driver of environmental change, food production systems can also be loci of social inequity and dis-empowerment. Notwithstanding, farming systems cam be sites of great biological diversity, social innovation, and peoples' empowerment, and are thus intimately linked to challenges with food security and sustainability in terms of both root causes and solutions (Steffen et al. 2015; Bennett et al. 2014; Schipanski et al. 2016). However, agricultural production systems in their different forms have varying levels of potential and capacity to address complex food systems challenges including enhancing social equity, environmental sustainability and economic viability of food production.

While there is a great diversity of production models being employed worldwide, the global agri-food system is increasingly characterized by a trend towards industrialization and away from diversification (IPES-Food 2016). This style of production is also associated with the increased use of inputs, higher rates of mechanization, larger scale production, monocultures and increased integration into the global market (Tilman et al. 2002; Lin et al. 2011; Vandermeer & Perfecto 2012; Iles & Marsh 2012), leading to decreased resilience of both production and distribution systems (Schipanski et al. 2016). In developed regions of the world such as North America, these production systems have proliferated since the Green Revolution, and are not only the dominant mode of production, but in many cases, are embedded in conceptions of rurality and conventional/traditional farming (Wittman 2009b).

However, the complexity of our food systems makes it difficult to untangle the diverse impacts of these dominant modes of production, or to understand what kind of shifts in practices

might be desirable. This complexity is punctuated by multi-scalar dynamics[1], feedback mechanisms, and interactions between social and ecological systems (Holling 2004; Folke et al. 2005; Liu, Dietz, Carpenter, Alberti, et al. 2007). According to recent studies looking at the extent of trade and use of foreign crops globally, 69% of national food supplies are from foreign crops (Khoury et al. 2016; Otero et al. 2013). Particularly as distant regions become increasingly interconnected through travel and trade of various commodities, there is an urgent need to understand food production systems in particular locales – and the socio-political dynamics that shape them – in relation to the larger scale international commodity networks in which they are embedded (Adger et al. 2009; Liu et al. 2013; Liu et al. 2015; IPES-Food 2015).

Cropland in North America accounts for 14 percent of global crop-harvested area (Monfreda et al. 2008). This agricultural production consists of many different styles of cultivation for food, fodder and fuel, in addition to grazing, ranching and other animal feeding operations. However, industrialized agricultural production proliferates, particularly for exportable commodity crops (Otero et al. 2013). Some scholarship seeks to examine the various impacts and outcomes of industrialized food production, including impacts on biodiversity (Tuck et al. 2014), social equity (IAASTD 2009), resilience (Rotz & Fraser 2015) and family farming in certain contexts (National Farmers Union 2010), global dietary diversity (Khoury et al. 2014), and waste from distribution losses (Lundqvist et al. 2008). However, much of the scholarship regarding the social outcomes of industrial agriculture is focused on the Global South, and

[1] When referring to multi-scalar dynamics, and the concept of 'scale' generally, I am referring to the distance as defined by system boundaries, including geographic scale (Vancouver as nested within the province of British Columbia), institutional scale (farms as being part of larger institutional networks of trade policy, with various intermediaries), and, to a lesser extent, temporal scale. The institutional scale is of particular importance in this study, as it draws attention to the various potential points of intervention in the system (e.g. high level policy implications of research).

analyses of crosscutting themes and systems dynamics in the different manifestations of agro-industrial production are lacking.

Considering the dominance of industrial agricultural production in the landscape of the Global North, as well as the increased use of industrial practices in developing regions (including the adoption of input-intensive practices by smallholder farmers), there has never been a more crucial moment to understand how these systems are linked to larger scale societal issues (whether social, economic or environmental). For example, there is currently much research and policy calling for "sustainable intensification" in the name of increasing food production, and yet the full range of social and environmental impacts of intensifying agricultural production is not adequately understood (Loos et al. 2016). As such, there remains a significant need to investigate and critically assess the multi-scalar social, institutional and geographical dynamics surrounding these transitions with respect to agricultural labour, power relations, and farmer livelihoods.

As a concept that has increasingly been invoked in discussions of social and political food systems dynamics, *food sovereignty* calls for the holistic consideration of human and ecological aspects of agricultural systems. Both social movements and academic discourse related to food sovereignty focus on power and politics within the food system, aiming to create more sustainable food systems through enhancing farmer livelihoods, re-localizing food systems, and working with nature (Wittman 2011; Patel 2009). It can be defined as the right of people to determine their own food systems and agricultural policies, which includes ways of producing food, accessing markets, and maintaining or exerting control over ecological resources (Schavioni 2009; Wittman 2011). As such, food sovereignty is a framework that connects the rights of people to social, economic and ecological systems. Through academic literature, civil engagement, and policy discussions, food sovereignty has evolved to represent a process based

on a set of guiding principles, and is meant to be adapted to the specific conditions and characteristics of a particular locale.

The concept of food sovereignty was born out of civil society organizing largely in the Global South, and to date, academic scholarship related to food sovereignty has largely been focused on the global south, and the promotion of local food systems (Wittman 2011; Martínez-Torres & Rosset 2014; McMichael 2016). Particularly in earlier conceptualizations and definitions of the food sovereignty movement, there was significant emphasis placed on the right to national self-reliance and local self-sufficiency (Agarwal 2014) in addition challenging neo-liberal trade regimes (Wittman et al. 2010). However, there is a conceptual leap between the goal of self-sufficiency, and the nuanced and multi-dimensional concept of food sovereignty. Indeed, many studies have concluded that a localized food system does not guarantee food sovereignty (Robbins 2012; Hinrichs & Allen 2008).

However, there are gaps in our knowledge about how farmers in the Global North, using a spectrum of growing techniques and business models, and at varying scales of production, fit within the conception of food sovereignty as discussed in the literature. Apart from alternative food networks and local food initiatives, little empirical evaluation of how export-oriented and industrial food systems relate to the food sovereignty framework has been conducted, despite the involvement of Canadian organizations in the food sovereignty movement since early on in its evolution (Desmarais & Wittman 2014; Wittman et al. 2011; Andrée et al. 2011). As a result, we have limited understanding about how producers within the context of the Canadian agri-food system might be enacting food sovereignty principles whilst participating in the global economy via export.

In order to understand how and to what extent food sovereignty principles can be enacted in diverse geographic, cultural and economic contexts, we investigated a northern and export-oriented agricultural production system as a distinct case study. The blueberry industry in British Columbia, Canada is socially and economically significant within a regional food system, and is globally integrated through export and trade. This research seeks to assess how the principles and processes for food sovereignty could be operationalized analytically in the blueberry industry in British Columbia, Canada, with a focus on growers as principal decision-makers at the farm-level.

Chapter 2 will first discuss the conceptual framing of food sovereignty based on the literature and as employed in this research, followed by a description of my conceptual framework and study objectives, which are: (1) to contribute to the discussion on the role of export-oriented agriculture in the achievement of food sovereignty principles, and (2) to operationalize food sovereignty theory as a structured methodological tool in a particular context to assess socio-ecological processes and outcomes of an export oriented production system. Chapter 3 describes the context in which blueberry production occurs in Canada, and presents a review of existing knowledge related to the BC agricultural sector, concluding with a justification for this study's focus on blueberry growers as an entry point for understanding how and to what extent the principles of food sovereignty are exhibited within the industry. Chapter 4 discusses the methodology, hypothesized food sovereignty processes and outcomes, and a description of the methods used for data collection and analysis. Chapter 5 presents results from an empirical evaluation of how food sovereignty principles are exemplified (or not) in the blueberry industry based on interviews with growers within the blueberry sector in BC. This chapter discusses labour challenges, grower livelihoods, and distributions of power. Chapter 6

discusses how the results presented in Chapter 5 relate to existing scholarship on principles, processes and outcomes related to food sovereignty, followed by concluding remarks in Chapter 7.

Chapter 2. Background

2.1 The Conceptual Framing of Food Sovereignty

The food sovereignty movement – *La Via Campesina* – emerged in 1993 from a convergence of 148 civil society organizations and social movements representing small-scale and family farmers from 69 countries from the Americas, Africa, Asia, and Europe (Wittman 2009). The international peasant movement brought the concept to the attention of global leaders at the 1996 World Food Summit in Rome, and was then, as it is now, a response to trade liberalization, corporatization and specialization in agriculture. Since the World Food Summit, the concept of food sovereignty has increasingly been invoked in policy debates and articulated as a priority by various civil society organizations worldwide (Wittman 2009b; Schavioni 2009), as well as integrated into some national legislative frameworks, particularly in Latin America (Knuth & Vidar 2011; Clark 2013; Godek 2015). Food sovereignty literature is growing rapidly as scholars seek to address tensions regarding the distinction between sovereignty versus self-sufficiency (Agarwal 2014; Bernstein 2014); disputes on the relative merits of trade and market integration (Burnett & Murphy 2014; Jansen 2015); and the contradictions between scale, where food sovereignty can be achieved at some levels but at the expense of others (Iles & Montenegro de Wit 2014; Edelman 2014).

In an attempt to situate the food sovereignty debate within the larger discourses surrounding food production, many food sovereignty scholars contrast the concept with food security and "sustainable agriculture" (Pretty et al. 2011; Fraser et al. 2015). These comparisons have been a polarizing topic of debate among scholars in the area, and as both definitions have evolved considerably in recent years, it can be challenging to disentangle the multiple meanings of the concept in relation to how it is employed by diverse actors (Clapp 2014; Jarosz 2014; Agarwal

2014). However, it is helpful to highlight some elements of the food sovereignty concept that have made it distinct in orientation, and continue to be articulated by scholars and activists alike in a way that is distinct from food security and sustainable agriculture narratives that have been employed historically.

Food sovereignty places importance on *how, by whom* and *for what* food is produced. As such, like the sustainable agriculture literature, it takes the ecological impacts of food production into account, and advocates for agroecological principles that work with nature. Food sovereignty arguments critique what is viewed as an increasing corporate control of food systems, and are as such opposed to what scholars refer to as the neoliberal food regime, characterized by "free" markets that have minimal state intervention and privilege corporate agricultural interests (McMichael 2009b; Otero et al. 2013; Jarosz 2011; Pechlaner & Otero 2008). Further, food sovereignty proponents consider food to be more than a commodity, and advocate for the "right to food", whereby access to adequate food is considered a basic human right. Consequently, this implies the legal role and responsibility of state in ensuring regular, permanent and unrestricted access to adequate, sufficient and culturally appropriate food (FAO 2016).

Significantly, food sovereignty has placed emphasis on the social and political elements, such as access to land, the distribution of resources, and the empowerment of farmers and farm workers, which have been shown to be important determinants of both food security and environmental outcomes in agricultural contexts. As such, food sovereignty is considered to be a necessary precursor to just and "sustainable" food security (Patel 2009). Food sovereignty also offers an alternative to reductionist approaches aimed at creating more sustainable agricultural production by isolating single criteria and variables, and responds well to the broader

consideration for social equity as called for by many scholars (Loos et al. 2014; Pollini 2009). Because of this simultaneous attention to ecological relationships, power dynamics between scales, the rights of people and communities, and the role of institutions in enabling these rights, food sovereignty is a conceptual framework that allows the assessment of multi-scalar socio-ecological dynamics in food systems.

The concept of food sovereignty is necessarily adaptable to context. The 'unity in diversity' principle is at the core of the food sovereignty movement, and recognizes the value of place-based, though not necessarily local, food systems (Wittman 2011). As such, it is often referred to and conceptualized differently by different groups; some refer to it as a movement (Burnett & Murphy 2014), whereas others consider it a paradigm (Rosset 2008). As a dynamic and evolving concept, the way that actors define food sovereignty is adapted to contextual factors and local realities; however, the ways in which food sovereignty can be translated is bounded by a distinct set of ideas and principles on which the concept is based. These principles (below) have been defined through participatory events and networks involving hundreds of civil society organizations (Schavioni 2009; McMichael 2014; Martínez-Torres & Rosset 2014; Nyéléni 2007). As a result of this iterative evolution, food sovereignty can be viewed as an emerging paradigm that has potential as a theoretical tool to evaluate political and social system dynamics that have been largely overlooked in other approaches to looking at our food system (e.g. sustainability, neo-liberal economics, localization, food security) (Fairbairn 2012). It is for this reason that I will also use the term as referring to a framework, guided by a set of broad principles that give structure, but not necessarily prescription, to agricultural transformation.

This study employs the concept of food sovereignty by drawing on these key principles that have emerged from civil society mobilizations and subsequently were articulated in academic

literature. The basic principles of food sovereignty provide a starting point in the effort to transcribe this concept into a methodological tool for assessing food systems.

The principles are as follows (Nyéléni Forum for Food Sovereignty, 2007):

1. The perception of food as a human right versus a commodity
2. The value placed on equity and empowerment for all food providers
3. The emphasis on the social and ecological benefits of localizing food systems
4. The call for local control over resources and knowledge
5. The support for local knowledge and protection of community intellectual property rights
6. The significance placed on agroecological practices

From these principles, our research team has distilled the food sovereignty framework into three conditions necessary to achieve food sovereignty: equity, empowerment, and ecology and seek to operationalize these in order to assess food sovereignty principles in a particular context.

2.1.1 Equity

One of the pillars of food sovereignty is to "value food providers" by enabling a more equitable distribution of rights and resources between farmers, farmworkers, consumers, and the larger food distribution system (La Via Campesina 2009). While equity has historically been under-represented in research and scholarship as a determinant for food security (Schipanski et al. 2016), food sovereignty scholarship has highlighted the importance of equitable access to

resources such as land, capital, and genetic material, which can be considered productive equity (Windfuhr & Jonsén 2005). This access can be mediated by cultural, economic, structural or political forces, some of which are the legacy of historical processes. For example, high land costs are an economic barrier for new farmers to access productive resources, and are a product of market trends, financialization of land, agricultural land policy, and urban development of the past and the present.

In addition to equitable access to the means of production, it is also possible to assess equity of systems outcomes. For example, farm workers face significant health risks in comparison to other sectors of employment due to exposure to agricultural chemicals, repetitive and strenuous physical tasks, and regular contact with machinery and other hazards (Alavanja et al. 2004). The intersecting narratives of health equity and food sovereignty are particularly helpful here, as they highlight the uneven distribution of negative health outcomes among certain groups or populations within the food system (Weiler et al. 2014). This research will operationalize the concept of equity in terms of the distribution of access to productive resources and health outcomes in the food system.

2.1.2 Empowerment

The notion of empowerment is an integral pathway to food sovereignty, and is one of the distinct aspects of the food sovereignty framework that distinguishes it from other normative definitions of food security. Raj Patel (2012) highlights this cardinal difference in his essay on power and food sovereignty, contending that it is possible "to be food secure in prison where one might continually access safe and nutritious food, yet remain fundamentally disempowered over the process and politics of the food's production, consumption, and distribution" (p. 1). Many

scholars postulate that empowerment in the food system, particularly of smallholder farmers, is the only viable way for a community to meet its food security needs, echoing the idea that food sovereignty is a precursor to true food security (Altieri & Toledo 2011; Patel 2009). Yet, many of the existing assessments of empowerment and food sovereignty focus on marginalized farmers in developing countries (e.g. Altieri & Toledo, 2011; Wittman, 2009a).

An important mechanism through which all actors in the food system may gain power and control over decision-making processes regarding their food system is through democratic participation in socio-political governance processes and civic engagement, which are at the core of food sovereignty principles. Participation and engagement with these activities strengthen the socio-political networks of the food system and empower individuals and communities to contribute to and make decisions about their food system (Windfuhr and Jonsén 2005; Binimelis et al. 2014; Seed et al. 2012). Furthermore, governance mechanisms that involve citizens, institutions, and organizations at multiple organizational levels can play an important role in enhancing resilience of the socio-ecological system (Folke et al. 2005), can lead to political action (Scheufele et al. 2004) and can promote sustainable landscape management for biodiversity (Vandermeer and Perfecto 2008). However, it is also important to examine the ways in which empowerment can be limited to certain groups, such as when opportunities to participate are not equitably distributed due to political or economic priorities, or the ways that institutions structure norms and social interactions that act as barriers to sustainable practices (Abson et al. 2016; Pretty 2003).

In addition to political participation variation, economic factors can also influence actors' autonomy by mediating or constraining their choices (Hendrickson & James 2005). For example, farmers may be dis-empowered or constrained in their choices to use certain growing practices

(e.g. varietal choices) in order to maintain business viability despite decreasing margins. For the purpose of this research in the BC context, I will treat empowerment as a process that includes power in decision-making, and will define and operationalize empowerment as being both political (participation and having a voice) and economic (through the exercise of autonomy within a constrained system).

While equity and empowerment are intricately linked, I will treat them as separate, but related, phenomena in this discussion and analysis. I will distinguish between equity and empowerment as being a "state" (or outcome), and a process, respectively, consistent with the concepts of distributive justice and procedural justice (Loos et al. 2014). For example, the in-equitable access to land experienced by farmers in British Columbia will be treated as an outcome, as opposed the process of dis-empowerment due to economic barriers that constrain the choices of farmers.

2.1.3 Ecology

The importance that the food sovereignty movement places on how food is produced is an important way that food sovereignty is conceptually distinct from other frameworks seeking to address food insecurity. The principle of "working with nature" by decreasing dependence on external inputs and enhancing ecological processes is consistent with the literature on agroecology (Tomich et al. 2011), resilience theory (Lin, 2011), ecosystem services (Kremen et al. 2012) and sustainable agriculture (Ponisio et al. 2014). In this research, I operationalize ecology to reflect these principles, generally seeking to foster biodiversity as a regulating mechanism to buffer against climate change and disturbances, to enhance and support ecological

processes and ecosystem health, and to optimize yield. The following components will be highlighted in my conceptual framework:

Climate Change. As a sector that is highly coupled with natural systems (Liu, Dietz, Carpenter, Alberti, et al. 2007) and heavily influenced by weather patterns, agriculture is already at the mercy of changing climatic conditions. Farmers everywhere will be dealing with new conditions and increased variability, leading to enhanced challenges with pest problems, economic volatility of markets, and resource scarcity (Porter et al. 2014).

Pest Management. Pesticides have been shown to have negative environmental impacts, including harm to non-target organisms (pollinators, other beneficial insects, aquatic organisms, etc.), negative impacts on soil life, negative health outcomes for humans, and the development of resistant insect populations over time (Thomson, 1999; Brittain & Potts 2010; Henneron et al. 2015). While the use of these chemicals can help reduce crop losses from pests in the short term, the sustainability of such practices and their effectiveness remains contentious, and increasing research into alternative pest management in agroecosystems promotes preventative and integrated methods through enhancing beneficial biodiversity (Altieri & Nicholls 2004; Kremen et al. 2012; Letourneau et al. 2011). As such, the use of agricultural chemicals for pest suppression must be balanced with negative health and ecological outcomes of pesticide use.

Soil, water and nutrient management. Soil health is an important determinant of ecological productivity and general ecosystem function. Moreover, the increased use of nutrient inputs in the form of fertilizer has created imbalances in global nutrient cycles (MacDonald et al. 2011;

Galloway et al. 2003), contaminating aquatic ecosystems (Rabalais et al. 2010; Bennett et al. 2001), and depleting non-renewable stores of valuable elements such as rock phosphate (Cordell et al. 2009). In addition to practices that enhance soil fertility and structure, there are several best practices that reduce soil erosion thus conserving soil within the field and reducing soil nutrient loading in nearby water bodies. As such, the use and extent of practices such as the addition of organic matter, the presence of shelter belts, buffer zones, or windbreaks, targeted irrigation systems, and conservation tillage practices have been shown to conserve soil nutrients and protect water quality over time (Tilman et al. 2002; Henneron et al. 2015).

Pollination. Pollination is an essential ecosystem function and can be a limiting factor for agricultural production (Benjamin & Winfree, 2014). The pollinator insects that play this role include bees (both wild and managed), wasps, moths and birds, all of which rely on natural areas adjacent to farmland (Ricketts et al. 2008). However, declines in managed honeybee as well as wild pollinators present a serious threat to the sustainability of blueberry production. Apiarists have been experiencing significant declines in honeybee colonies, and increased need for management of pests and diseases that are becoming more prevalent in colonies (Potts et al. 2010). This vulnerability to pests and disease outbreaks in colonies has been partly attributed to the high level of connectivity of this industry, and the stress that managed honeybees have experienced due to a lack of diversity in their food sources (pollen from flowering plants) (Gordon et al. 2014; Di Pasquale et al. 2013). Declines in landscape biodiversity and the proliferation of industrial agriculture have also elicited significant losses in wild pollinator populations. As such, the lack of biodiversity on farms and in the landscape, as well as our

increasing dependence on honeybees, threatens the efficacy and stability of agricultural production (Garibaldi et al. 2013; Senapathi et al. 2015).

2.2 Study Objectives

This research will operationalize food sovereignty as equity, empowerment and ecology as outlined above, and will use these concepts to examine how local producers in the BC blueberry industry are responding to pressures, constraints and opportunities in the global food system. The empirical assessment performed here corresponds to what the conceptual framing of food sovereignty suggests as important, and invokes 'states' and 'processes' relevant to this concept in order to investigate what the participation of growers in the food system yields in reality. The study seeks to accomplish the following objectives:

2.2.1 Contribute to Discussion on the Role of Trade in Achieving Food Sovereignty Principles

The extent to which food sovereignty principles can be expressed in export-oriented food systems remains under-explored in the food sovereignty literature. Historically, the food sovereignty movement has positioned itself in opposition to organizations such as the WTO, and to global free trade agreements, such as NAFTA, that have been shown to reduce support for regionalized food systems and further concentrate power in an unequal global playing field (Wittman et al. 2010). Yet, the food sovereignty movement (if we are to refer to one unified movement) is not diametrically opposed to trade in and of itself. According to Philip McMichael (2009a): "food sovereignty movements politicize the current trade regime, revealing the complicity of states in incorporating agriculture into the reproduction of capital, rather than sustaining it as a site of social and ecological reproduction." In fact, food sovereignty scholars have been deeply engaged in discussions about the nature and conditions of trade agreements

(Wittman 2011; Burnett & Murphy 2014; Burnett 2014; Trauger 2014), and several have illuminated the potential for trade to be not only acceptable under certain conditions, but beneficial for food security, farmer livelihoods and/or autonomy (Burnett & Murphy 2014; Edelman 2014; Bacon 2015). Considering the importance of trade in our globalized food system, and the reality that more and more farmers from developing and developed nations alike are "choosing" to engage with the global marketplace, the food sovereignty movement's relationship with trade should be explored. This requires a thoughtful examination of the conditions under which trade might provide a pathway to political and economic empowerment and social equity, without compromising the ecological stability of the system.

This analysis takes up a case study of the blueberry sector in BC in order to address this empirical gap, and in order to contribute to the conversation about the place of trade and other international processes as part of the consideration of food sovereignty at multiple scales, as opposed to idealizing the local scale (Iles & Montenegro de Wit 2014). The nature of the blueberry industry as a predominantly export-based crop problematizes the dominant focus in the food sovereignty literature on regionalized food systems oriented to domestic consumption, and presents an opportunity to explore the tensions between food sovereignty and trade highlighted by Burnett and Murphy (2014), and to look across the spectrum of agricultural practices at synergies and trade-offs between indicators of food sovereignty.

2.2.2 Operationalize Food Sovereignty Theory as a Lens for Developing a Structured Methodological Tool

The second objective of this research is to operationalize the concept of food sovereignty in a clear way and in a particular context. In order to achieve a balance between concrete

translation and application of food sovereignty principles while maintaining reflexivity in an assessment tool, we have derived indicators of food sovereignty that are informed by the literature while being adapted to context. We have then undertaken an in-depth case study focusing on blueberry growers as key stakeholders in the BC regional food system and agricultural management to deepen our understanding of the concept food sovereignty in a single sector from the perspective of that group. In addition to an in-depth assessment of how and to what extent the principles of food sovereignty are both experienced and affected by this group, we conducted interviews and analyzed existing literature to contribute to a multi-scalar and multi-stakeholder analysis of system dynamics within the blueberry sector. We see the conceptual framework of food sovereignty as emergent and dynamic, and as such, seek to apply it in a structured way to explore its utility as a framework for assessing critical and poorly understood socio-ecological dynamics in food systems. This research seeks to respond to critiques of food sovereignty as vague and atheoretical while remaining adaptive to context and cognizant of multiple scales, which is integral to assessing complex socio-ecological systems (Ostrom & Cox 2010). In order to avoid the creation of simple prescriptions to address complex problems, the close examination of individual cases is essential for an in-depth understanding of relationships and processes within the system of study (Poteete et al. 2010, p. 33). As such, this study takes up the case study of the blueberry industry in British Columbia in order to examine commodity-specific dynamics within a particular socio-ecological context.

Chapter 3. The Context of Blueberry Production in British Columbia: Implications for Food Sovereignty

While Canada is home to many initiatives and organizations aiming to provide more local alternatives to the globalized and industrial food system (e.g. Food Secure Canada, Farm to Cafeteria Canada, Young Agrarians), the direction of federal policy for the Canadian agri-food sector is towards large-scale, input intensive, productivity-focused modes of agriculture that are heavily integrated into international markets (De Schutter 2012). Canada is a significant player in the global marketplace and is the world's fifth largest exporter of agricultural products, with 58% of production exported beyond Canadian borders, and 51.4% of that going to the United States (Agriculture and Agri-Food Canada 2016). Canada is also the world's sixth largest *importer* of agricultural goods, and more than 61.4% of these products are from the United States. Commodity crops dominate agricultural production: grains, oilseeds and red meats accounted for 63.2 % of total market receipts in 2014 (Agriculture and Agri-Food Canada 2016).

Demographic trends in Canadian agriculture illustrate the impacts of an increasingly consolidated industry. The average farm size in Canada has increased from 598 to 778 acres between 1991 and 2011, and the number of farms in the country has dropped by 27% during the same time period (Dorff 2014a). The average age of farm operators has also been rising, with an increase from 47.5 to 54.0 years between 1991 and 2011, and a decline of almost 75% in the number of farms with operators less than 40 years (Dorff 2014a). This is both a symptom of problems with barriers to land access, and a challenge for land and knowledge transfer as a large proportion of landholders become unable to farm (Dennis 2015).

In his writing about food sovereignty in Canada and the devastation of farming, Darrin Qualman skirts tensions about the definition of food sovereignty by writing about what it is *not*.

What he lists is a characterization of the industrial food system, including maximizing yield through intensive practices, concentrated power and land ownership, non-protectionist economic policies, and dependence on trade and imports (Qualman 2011). This description, as he points out, also applies to Canadian agricultural and food policy. Indeed, food sovereignty represents a discursive response to the industrial food system, and is concerned with the rights of people, with particular emphasis on smallholder and agroecological farmers. In other words, Qualman posits that the Canadian food system is the antithesis to food sovereignty.

Other scholars have echoed these criticisms. In a report investigating the realization of the right to adequate food in Canada, former UN Special Rapporteur on the Right to Food raises concerns about the protection of social and economic rights, rising food insecurity, increasingly industrial production practices, and a decreasing number of farms. He highlights the role of the federal government in exacerbating many of these issues through international trade deals, and the dismantling of institutions and policies that protect Canadian farmers (De Schutter 2012). Civil society organizations have also voiced their concerns about the way that agricultural laws, policies and institutions are affecting food sovereignty in Canada through exorbitant land prices, accelerating farmland consolidation, and increasing farm debt (National Farmers Union 2010; National Farmers Union 2015).

Though the national-level policy agenda may reflect the antithesis of the food sovereignty movement in many ways, individual farms, communities and regions display a more complex picture. There is a patchwork of arrangements that make up Canadian agriculture, with many different permutations of practices and characteristics that fall within a spectrum between a contrived binary between the industrial and the 'food sovereign' farm or region. In other words, while we can place food sovereignty in direct opposition to much of the national agricultural

policy in Canada, many farmers (and their farms) could not be placed so neatly in any one place between the two poles. Despite increasing farm size, family-owned and run farms remain prominent fixtures in rural landscapes, and Canadian organizations such as the National Farmers Union and Quebec's *Union Paysanne* are active in the food sovereignty movement, and have been members of *La Via Campesina* since its early activities (Andrée et al. 2011; Statistics Canada 2012a).

A discussion of food sovereignty principles is present in Canada (Levkoe 2011; Levkoe & Wakefield 2014; Levkoe 2014), but this conversation is taking place in different ways at the scale of the individual, region and nation, each with their different backdrop. As such, taking a more nuanced approach to examining the component parts of the food sovereignty framework, and the various ways that food sovereignty principles can be enacted by farmers who may also be engaged with productionist and/or export-oriented agricultural systems, is a helpful way to tease out the complexity inherent to operating an agricultural operation nested within larger social, economic, and cultural forces.

3.1 Overview of the BC Agriculture Sector

Agriculture in British Columbia (BC) provides an extreme example of many of the socio-economic trends seen across the country, combined with a unique set of challenges as a result of regional characteristics. Like the rest of Canada, farming in BC faces the linked challenges of fewer farmers, larger farms and a rapidly ageing farmer population, with the highest average age of farmers in the country at 55.7 years (BC Ministry of Agriculture 2012c). With only 6.4% of farms with young operators (the lowest proportion in Canada), there are insufficient new entrants to agriculture to replace the ageing farmer population (BC Ministry of Agriculture 2012b). This

implies a difficult transition ahead, as the farmers themselves are a primary asset for enhancing agricultural resilience, and as older farmers near retirement, there will be a significant loss of knowledge and expertise in the province (Weiler et al. 2015; Crawford & MacNair 2012).

Against this backdrop of challenges with lack of new entrants to farming, and inter-generational land transfer, some aspects of the BC agricultural system are distinct from trends in other provinces, and present a unique opportunity for food sovereignty evaluation. Farms in British Columbia are among the smallest of any other province in Canada, with an average farm size of just 327 acres in 2011, compared to the national average of 778 acres (Statistics Canada 2012b). With respect to farm management and ownership, 98% of the province's farms are family-controlled, and it has the highest share of female farm operators in the country at 37% (BC Ministry of Agriculture 2012b). It is also the most diverse in Canada with more than 200 commodities produced (BC Ministry of Agriculture 2012a).

BC agriculture also occurs on a relatively limited land-base, with only 4% of Canada's total farm acreage, but 13% of the country's population (British Columbia Ministry of Agriculture, 2012; Statistics Canada). In fact, total farm area represents only 2.8% of total land area (compared to 42.4% in Saskatchewan), with only 1% of arable land considered to be prime farmland (Crawford & Beveridge 2013; Statistics Canada 2012d). Similar to trends across the country, BC agricultural land has decreased steadily (BC Ministry of Agriculture 2012c).

The Lower Fraser Valley, which encompasses the Metro Vancouver and the Fraser Valley regional district (Figure 1), is one of the most intensively farmed regions in Canada, and provides good conditions for agriculture, with fertile soils, ideal topography, and historically abundant rainfall to recharge aquifers for irrigation (Fraser Valley Regional District 2011). The

area around Vancouver and the Lower Mainland is also home to more than 75% of the province's population (Walker & Sydneysmith 2007).

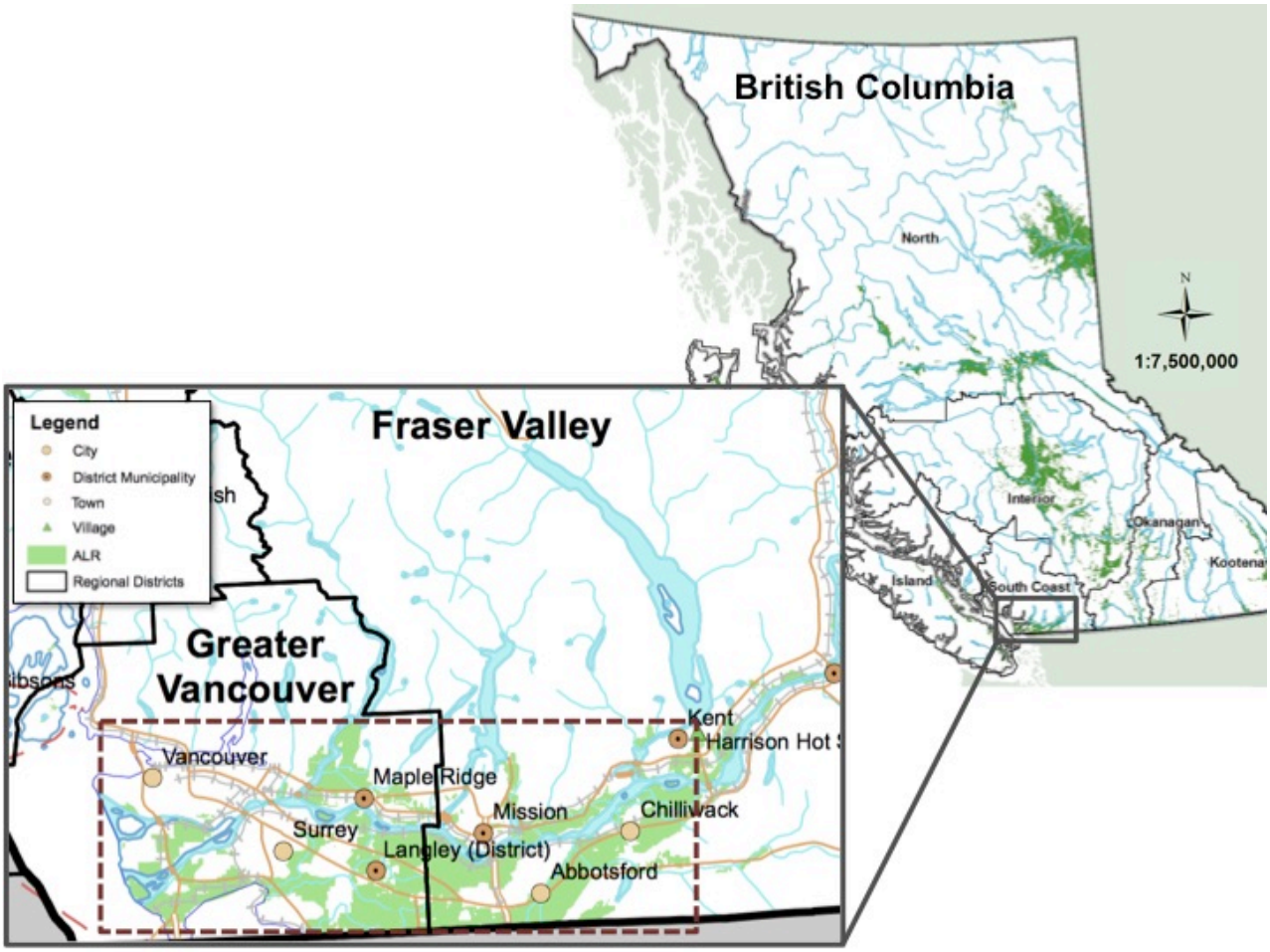

Figure 1. Map of the Lower Fraser Valley region in South-western British Columbia
The study area (Lower Fraser Valley) is indicated by the red rectangle, which encompasses parts of Greater Vancouver and the Southern part of the Fraser Valley. Green areas indicated agricultural land that is part of the Agricultural Land Reserve (ALR). Maps adapted from the Provincial Agricultural Land Commission (ALC 2014).

In terms of economic significance, the Lower Fraser Valley region (Lower Mainland Southwest in Figure 2) has the highest number of farms and the highest farm gate values in the province, with 66% of the province's total gross farm receipts by dollar (Figure 2)(Statistics Canada 2011), despite representing only 5% of the province's total farmland area. However, in

such close proximity to a rapidly expanding urban region of Metro Vancouver, there is development pressure at the urban-rural fringe (Condon et al. 2010; Newman et al. 2015), and land prices that are more than double the Canadian average (Statistics Canada 2015).

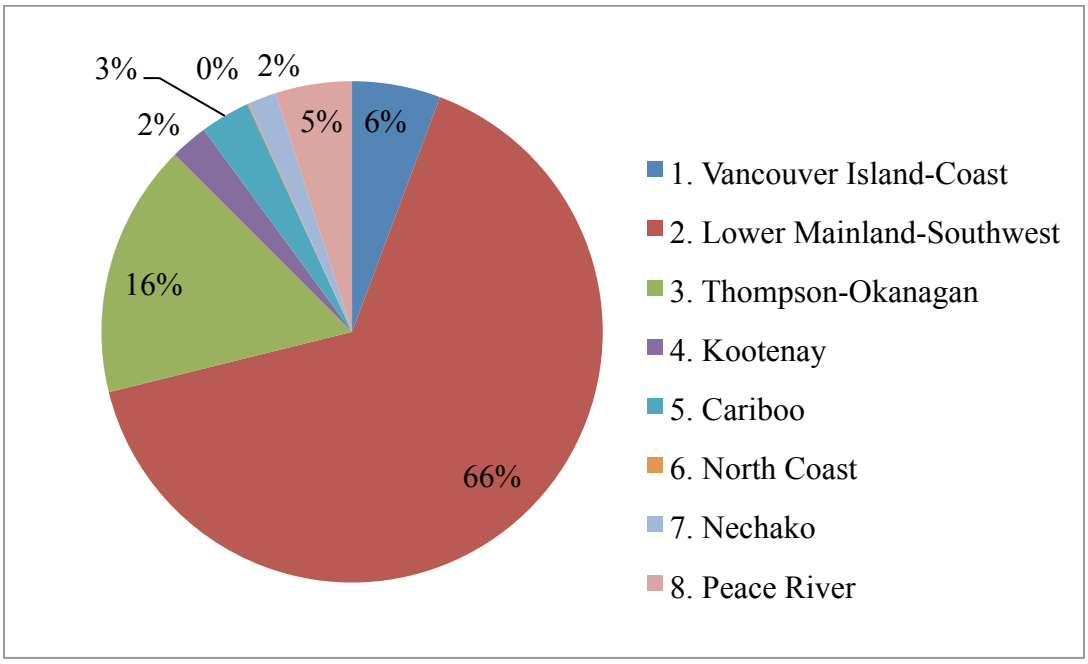

Figure 2. Total Gross Farm Receipts by Census Agricultural Region in British Columbia
The proportion of total gross farm receipts by Census Agricultural Regions in the province, showing the relative significance of the Lower Mainland-Southwest. Data from Table 004-0233 Census of Agriculture.

Another important element of production in the Lower Fraser Valley region is access to trade and markets via the Port of Metro Vancouver and the border with the United States in close proximity to the south. These corridors make export both possible and desirable for producers in the region, providing them with diverse market opportunities from the United States to Asia, to complement demand from the relatively small local population. In 2014, BC exported $2.0 billion worth of agriculture products ($2.9 billion in farm cash receipts were generated provincially in 2013), with exports destined primarily for markets in the U.S. (76% of exports), and Asia, with Japan (5%), China (4%), Taiwan (2%) and Hong Kong (2%) (BC Ministry of

Agriculture 2015b). Food products for manufacturing were the largest export ($235 million), and blueberries were the province's second largest export ($169 million).

Despite the slant towards industrial and export-oriented production, the food system in British Columbia is far from a monoculture. It is a regionally diversified system, with an active local food movement and many actors working towards food sovereignty in different ways (Desmarais & Wittman 2014; Dennis 2015). While agriculture in the province is highly oriented towards export and growth of particular commodity sectors (BC Ministry of Agriculture n.d.), it is embedded within a landscape exhibiting diversity in production, with distinct opportunities and challenges. Food sovereignty evaluation holds particular merit to assess and hone in on the complexity of export oriented agriculture and trade within a region that is highly productive and has potential to be more regionally self-reliant as an agricultural system (Dorward 2015; BC Ministry of Agriculture and Lands 2006; Mansfield 2014).

3.2 Food Sovereignty in BC Agriculture

While food sovereignty in the context of industrialized agricultural systems has been largely under-studied, there are several aspects of food sovereignty and its component parts that have been assessed in British Columbia. Consistent with our conceptual framework presented in section 2.1, this section provides an overview of what is known about equity, empowerment and ecology with respect to the agricultural industry in British Columbia. This is not intended to be an extensive discussion of all of the food systems dynamics related to these aspects of agriculture in the province, but rather an opportunity to synthesize what is known from existing research, and to focus on some of the key issues highlighted in the scholarship regarding equity, empowerment and ecology across the province and in Canada. This discussion provides an

overview of dynamics that are relevant to the blueberry industry in order to situate the appropriate historical and economic context.

3.2.1 Equity: Land Access and Labour

The distribution of access to productive resources, or productive equity, is an integral component of food sovereignty theory, and as a result, the economics and politics surrounding land access in the Fraser Valley are paramount in any consideration of equity in this agricultural system. The history of colonial settlement and land titles in Western Canada has contemporary implications for productive equity in Canada, as most of the land in the province, including agricultural land in the Fraser Valley, is unceded traditional territory of the Coast Salish peoples (BC Ministry of Education n.d.). While the challenges and injustices surrounding First Nations' access to traditional foodlands is beyond the scope of this project, it represents a significant and pre-existing inequity in the BC food system. Concurrently, the increased concentration of farmland in the hands of fewer farmers, and the inaccessibility of land to new entrants as a result of economic barriers are also contributing to the in-equitable outcomes in the food system. The exorbitant cost of resources and inputs, and particularly in the Lower Fraser Valley, the cost of land, is perhaps one of the greatest challenges to equity among farmers and farmers-to-be in the province. In the region of the Lower Fraser Valley, the average cost of farmland was estimated to be $49,500 per acre, which is more than ten times the national average of $4,300 per acre (Agriculture and Agri-Food Canada 2009). These exorbitant costs of land are contributing to increasing amount of debt incurred by Canadian farmers, which has increased by 21.8% between 2010 and 2013 (National Farmers Union 2015).

General input costs have also been on the rise for farmers in the province, including substantial increases in the price of seeds, fertilizers, and pesticides. Between 2004 and 2014, general input costs rose 47% across Canada, fertilizer and lime costs rose 103%, and machinery fuel costs rose 71% (Agriculture and Agri-Food Canada 2016). While farm revenue costs also rose during this period, it has not been sufficient to account for the extreme increases in input costs, particularly in BC. According to a recent report on climate change adaptation in BC agriculture, "net farm income in BC as a whole has been consistently negative, in part due to the costs of production out-pacing revenues" (Crawford & Beveridge 2013). These exorbitant costs have both direct and indirect impacts on farm owners, operators and workers. Most notably, they inhibit young and beginning farmers from accessing land, they lock farmers into a cycle of farm debt, and they contribute to a 'cost-price squeeze', all of which constrain the choices of farmers, and limits their ability to make autonomous choices about their own livelihoods and farming operations (Weiler et al. 2015; National Farmers Union 2015).

In addition to the in-equitable access to the resources required to farm in the province in the first place, the negative impacts of agriculture itself (and the benefits) are also disproportionately accrued to certain groups in the food system. One of the most significant inequitable outcome in the food system, and one that remains largely unexplored in food sovereignty literature, is that of the health and working conditions of agricultural labour (Weiler et al. 2014; Otero & Preibisch 2015; Otero & Preibisch 2010; Preibisch & Otero 2014). In the context of British Columbia, as well as in other parts of Canada and the United States, much of the fruits and vegetables produced depend on seasonal work performed by agricultural workers. Of all farms reporting hired farm labour in Canada, 62.4% of jobs were for seasonal or temporary workers. BC is among the largest employers of seasonal or temporary workers on

farms, employing 32,264 people seasonally or temporarily – 71% of total employees (Statistics Canada 2012c).

Whether seasonal or year-round, agricultural workers are exposed to higher risks and poorer working conditions than most other jobs in Canada, and are also excluded from certain benefits such as overtime pay (BC Employment Standards Branch 2016b). Farm labourers work long hours often more than 40 hours a week, under difficult physical conditions, and often for minimum wage or lower (Fairey et al. 2008). Increasingly, this work force is made up of immigrant and migrant labourers who are not properly compensated for the health and safety risks they are faced with day to day (Otero & Preibisch 2010). In both of these cases, these workers are often racialized, marginalized, and socially isolated. They often face significant language barriers with their employers and managers which can enhance risk, vulnerability and precariousness of labour dynamics (Preibisch & Otero 2014).

In the fruit and vegetable sectors in BC, most immigrant workers are from the Punjab region of India, and have often come to Canada through a family connection or sponsorship. Most of these workers are female, though males are also represented, and are usually middle-aged or older, and many of them have limited proficiency in English (Weiler et al. 2015; Preibisch & Otero 2014; Fairey et al. 2008; Runsten 2000). As a result of the limited or non-existent employment options for these workers, they can be forced to endure otherwise un-acceptable working conditions and wages.

Temporary workers employed through the Seasonal Agricultural Workers Program (SAWP) are another important class of workers that are crucial to blueberry production in the Lower Fraser Valley, and to the BC food system more generally. This federal government initiative allows farm operators to hire Temporary Foreign Workers (TFW) on temporary visas

from Mexico, and some Caribbean countries (Government of Canada 2015). In the five years following the extension of this program in 2004, the number of Mexican migrant farmworkers in BC increased 64-fold, and was estimated to make up half of the seasonal farmworker population in the province as of 2008 (Otero & Preibisch 2010). This number is expected to have risen since. There is ample evidence for unsafe, unhealthy, and unfair conditions that some migrant workers have to contend with (Paz Ramirez 2013; Hennebry & Preibisch 2010; Fairey et al. 2008; Read et al. 2013).

There is extensive scholarship that investigates the personal and health risks that both migrant and immigrant workers contend with as a result of employer-employee relationships (Read et al. 2013; Harrison & Getz 2015; Otero & Preibisch 2015; Preibisch 2010; Fairey et al. 2008). In the case of Canadian immigrant workers, many have received legal citizenship by way of family sponsorship. While this pathway of entry may seem benign, some workers have endured abusive relationships from their family employers either due to feelings of attachment for or indebtedness to them (Fairey et al. 2008; Otero & Preibisch 2015; Oxman-Martinez et al. 2005). Farm labour contractors are another mechanism that facilitates the access of immigrants to the labour market in the blueberry industry in BC (BC Employment Standards Branch 2016a). These arrangements present their own challenges for workers to achieve equity, either due to a reduced incentive for proper training with pesticide application, or barriers to pursuing complaints or legal action against employers (Preibisch & Otero 2014).

Migrant workers contend with particularly precarious working conditions due to the nature of their temporary status as being tied to and dependent on their employer. In many cases this extends to healthcare access – whereby workers must go through their employer to access their

healthcare, and thus face barriers due to confidentiality, and the risk of being deported and losing the opportunity for Canadian wages (Preibisch & Otero 2014).

Though the inequities facing immigrant and migrant farm workers in BC are the most dire, the nature of and challenges with agricultural work in BC extend to other groups of agricultural workers who are unevenly exposed to various social, economic and health risks. These include un(der)-paid interns on farms, particularly on alternative or organic farms (Weiler et al. 2016; Weiler et al. 2015). Inequities are not just common among labourers, many farm owners and operators also experience inequitable exposure to occupational health risks. Farm owners themselves who are economically marginalized and who struggle to make sufficient profit from farming to pay for exorbitant land costs are more likely to resort to practices that may create unhealthy working conditions (Weiler et al. 2014; Pilgeram 2011).

3.2.2 Empowerment: Income and Concentrated Power

The Lower Fraser Valley food system exhibits particular contextual characteristics that mediate producer empowerment in both economic and political ways. As outlined in section 2.1, I am operationalizing empowerment to refer to economic factors that constrain individual choice, as well as political empowerment through participation in governance processes whereby individuals can have a voice in the food system.

The increasing dependence on off-farm income is a trend that is intertwined with the cost of land and inputs in the province of BC. With increasing economic challenges and uncertainty in the agricultural sector, many farm operators seek paid work off of the farm as a means of diversifying income sources and reducing their dependence on the farm business. Recent

research about the BC agricultural system has highlighted concerns about off-farm labour being needed to sustain farming enterprises (Weiler et al., 2015).

According to the 2010 census, more Canadian farmers are allocating fewer hours of work on the farm (40% of operators are working more than 40 hours a week on the farm, as compared with 47% in 2005), though the majority of farm operators do not have off-farm work. This trend is more pronounced in BC, where only 26% of farm operators worked more than 40 hours a week on the farm, and 52.6% of operators had an off-farm job or business (Statistics Canada 2012e). In fact, BC farm operators have consistently had the highest percentage of their total income from off-farm sources of any province of the country, with 93% of their total income from off-farm sources, compared to the national average of 77%.

Research surrounding the resilience of farming systems recommend diversifying income sources in order to increase the adaptive capacity of farm households to economic or ecological disturbances (Darnhofer, Fairweather, et al. 2010). Additionally, if farmers in BC are choosing to farm part-time as a result of a preference to pursue off-farm work, this could be indication of autonomy and empowerment. Despite the clear trends shown at the national and provincial level, it is not clear whether farmers are working off-farm (and less on farm) out of necessity or by choice, and whether or not they feel constrained or empowered in that decision-making process. In the blueberry industry in BC, this relationship is also poorly understood. As the industry is concentrated in the region with the highest land prices in the province, and is dependent largely on seasonal labour, it could be suggested that farmers may a) rely on off-farm work to pay for the significant investment in land and b) are able to outsource at least some of the farm work to others during the peak season, leaving time for them to engage in paid off-farm work.

Patterns and processes that lead to increase in power (political and economic) of corporations and private entities, and decreased power and autonomy for producers, workers, and consumers, are characteristic of the neo-liberal food system, and are heavily at odds with food sovereignty. Whether through vertical integration, where individuals expand operations into packing and processing sectors of the food system, or simply the concentration of profit at higher levels of the food system, the food system in Canada is increasingly structured to represent the interests of processing and retail sectors at the expense of other stakeholders in the food and agriculture sector, notably primary producers and workers (Qualman 2011). At the national scale, the Canadian food and beverage processing industry was the largest manufacturing industry in the country in 2014, accounting for 16.6% of jobs, and 16% or $27.7 billion of the total manufacturing sector of GDP. In the same year, primary agriculture only represented 1.5% of Canadian jobs, a 3.3% decrease from the previous year. The proportion of national GDP from primary agriculture has also declined by 6%, while the share of the national GDP from processing, retail and food service sectors have all increased moderately (Agriculture and Agri-Food Canada 2016).

In BC, farmers have struggled to make any profit (Crawford & Beveridge 2013). While the Lower Fraser Valley is a highly productive agricultural region with the highest share of the value of gross farm receipts in the province, it is also a region dominated by agricultural commodities oriented for export, and with strong processing sectors. Blueberries are a chief example of such a crop. By contrast, the cranberry sector is governed by a grower-owned cooperative and a marketing board intended to share the autonomy and distribute the benefits of the marketing and processing of berries to growers (Ocean Spray 2016; BC Cranberry Marketing Commission n.d.).

3.2.3 Ecological Challenges: Resilience

BC's agricultural sector is expected to face both positive and negative bio-physical impacts from climate change (Walker & Sydneysmith 2007). It has been suggested that for northern climates, climate change will lead to improved productive capacity and new opportunities for agriculture in higher latitudes, resulting in a net benefit for countries like Canada (Walker & Sydneysmith 2007). While warming trends may be beneficial to some sectors, there is ample literature that suggests that this oversimplification is false (Crawford & Beveridge 2013; Belliveau et al. 2006; Walker & Sydneysmith 2007). Due to a number of recent dynamic shifts coupled with impending biophysical changes, agriculture in BC is likely to be significantly impacted by climate change. Worries about the risks posed to BC's agriculture by climate change have prompted various studies (e.g. Belliveau et al. 2006), most of which are baseline assessments of vulnerability, risk and adaptive capacity of the agricultural sector in general (Crawford & Beveridge 2013; Crawford & MacNair 2012; Ostry et al. 2011).

Temperatures are projected to increase across the province, which could result in increased productivity for certain crops in some regions, and longer growing seasons in general due to shorter winters. Overall changes in precipitation are less clear, but generally the province is expected to receive an increased amount of annual average precipitation (Walker & Sydneysmith 2007; Crawford & MacNair 2012). However, precipitation events are expected to be more extreme, and flooding and droughts are likely to present huge risks to agriculture and livelihoods in many areas of the province. In the Fraser Valley and Delta region in Lower Mainland BC, some projections have predicted an overall decrease in precipitation (Walker & Sydneysmith 2007), contrary to the projections by Crawford and MacNair, which predict an increase in annual precipitation for all regions.

In addition to potential crop losses from extreme weather patterns, agricultural producers in the Fraser Valley and in BC generally are also facing economic risks due to potential crop losses from pest outbreaks and threatened pollinator populations, both of which will be further exacerbated by the changing climate (British Columbia Agriculture & Food Climate Action Initiative 2015). Sustainable pest management is one of the most significant challenges faced by farmers around the world (Mortensen et al. 2012), and the government of BC has identified plant health issues including pest and pathogen threats as priority for achieving a strong and viable agri-food sector (BC Ministry of Agriculture 2013). Pesticide use in British Columbia has increased significantly in recent decades – between 2006 and 2011 the acreage on which fertilizers were applied increased 16.3% (BC Ministry of Agriculture 2012c) and there are growing concerns in literature regarding the dependence on and resistance to synthetic pesticides and the long-term negative outcomes that these can have on human and ecological systems (Mortensen et al. 2012). Research from the Lower Fraser Valley has found evidence of pesticide residues in farm ditches present major risk to non-target aquatic organisms (Wan et al. 2006), and local government, researchers and industry alike are promoting the adoption of integrated pest management practices to effectively manage pests and curb pesticide application rates in the blueberry industry as well as other sectors (Walsh et al. 2011; Hueppelsheuser & Sim 2014; BC Ministry of Agriculture 2003).

As an intensively farmed region, the Fraser Valley also faces the common challenges with regards to maintaining soil and water quality, and conserving these invaluable productive resources in the region. Due to high cost of land and inputs combined with the industrial nature of production, it might be expected for farming in the region to be highly efficient and geared towards optimizing production through targeted application of fertilizers. However, results from

2005 and 2012 studies looking at nutrient management in Fraser Valley Agriculture found that many fields had high residual levels of Nitrogen and Phosphorus, particularly for blueberries (BC Ministry of Agriculture 2014b). Notwithstanding, increases in input costs (particularly for fertilizers and lime, which increased by 103% between 2004 and 2014) and the recent decline in the price of blueberries could incentivize more efficient management practices such as custom blended and targeted application of fertilizers (e.g. fertigation) (Agriculture and Agri-Food Canada 2016).

3.3 The State of the BC Blueberry Industry

3.3.1 History and Growth

The previous section has highlighted dynamics relating to determinants of food sovereignty in BC and Canada. Considering this context, this section will outline the current state of the blueberry sector as it fits within these larger dynamics. While BC boasts the most diverse agricultural sector in Canada, the production is very regionally concentrated – certain production systems tend to be clustered in the different regions of the province as a result of distinct bioregional characteristics and historical growing conditions (Walker & Sydneysmith 2007). In the Lower Fraser Valley region of British Columbia, the blueberry industry is in many ways the face of contemporary agricultural production. Blueberries were the province's number one primary agricultural production export in 2012[2], with a total export revenue of $168 million in 2013 (BC Ministry of Agriculture 2014a). In terms of all agri-foods exports (including

[2] This is with respect to primary agricultural production from farmers, and so excludes fisheries, aquaculture, and post-farm processing. In 2014, blueberries were the second largest agri-food export (includes agriculture, seafood, and post-farm processing) behind food preparations for manufacturing (BC Ministry of Agriculture 2015b).

aquaculture and other non primary agricultural products), blueberries were only surpassed in export value by cultured Atlantic salmon and food preparations for manufacturing (BC Ministry of Agriculture 2014a). BC produces 95% of the country's high-bush blueberries (BC Ministry of Agriculture 2014a). In terms of total blueberry production (highbush and lowbush combined), BC has the highest market share of any province, with 46% of the total farm gate value, yet only 11.8% of the blueberry acreage, as a result of the high-yielding and intensive cultivation of highbush varietals (The Canadian Horticultural Council 2014). The blueberry industry is not only important provincially – it is Canada's most significant fruit production both in cultivated area and market value. It accounts for 56% of the total land base in fruits, and nearly a third of the value of total fruit farm cash receipts in 2012 ($247,272,000), surpassing the value for all tree fruits combined (The Canadian Horticultural Council 2014; Dorff 2014b).

Blueberry production has a significant natural history in the region. *Vaccinium Spp.* (the blueberry or huckleberry family) are among the few major agricultural crops native to North America (Khoury et al. 2016). The small, fruit-bearing shrub was an important food source for First Nations and Inuit peoples, who made use of the plant's leaves, roots as well as the nutritious berries, and was and continues to be a culturally significant food crop today (BC Ministry of Agriculture n.d.; Kuhnlein & Turner 2009). The lowbush or 'wild' blueberries (*Vaccinium angustifolium*) that are produced in Eastern Canada are native to that bio-region, and are related to the wild blueberries in the *Vaccinium* genus that have grown naturally in the Pacific Northwest. However, the cultivated highbush blueberry (*Vaccinium corymbosum*) that is grown throughout the Lower Fraser Valley today was domesticated in New Jersey in the early 1900s, and is the product plant breeding techniques (Charles 2015). The first highbush blueberries were planted in the peat bogs south of Vancouver in British Columbia in the 1920s,

which provided ideal mineral composition, pH and soil structure for blueberry cultivation (BC Ministry of Agriculture 2016). This experiment grew to a large-scale blueberry farm of hundreds of acres, and several plants remain in production today, having grown to seven feet tall and resisted drought and disease (Van Baalen 2009). As such, the highbush blueberry that is cultivated in the Fraser Valley today is not necessarily 'naturalized' to this bioregion, but a relatively recent arrival and the product of breeding and cultivation techniques. However, the local microclimate and soil types present in the original regions of cultivation allowed modern cultivars of the related native blueberry to thrive.

While First Nations peoples have participated in commercial blueberry (and related huckleberry) production and harvest, nations are largely concerned with the preservation of what traditional food lands they have access to, a partial consequence of the encroachment of the very agricultural expansion that the blueberry industry has contributed to. Concerns about the commercialization of the berry industry in British Columbia have been "regularly expressed" by elders due to the lack of significant and appropriate reserve land and access to traditional harvesting activities (Richards & Alexander, 2006, p. 91).

Despite the long history of the blueberry plant in North America, the substantial growth in the sector in BC has been relatively concentrated in the recent decade. Between 2011 and 2013, export value of blueberries grew by 20% (BC Ministry of Agriculture 2014a). In addition to economic value, the land area planted in blueberry bushes has also grown significantly. Between 2006 and 2011, blueberry acreage grew by 77%, the commodity demonstrating the largest increase in land devoted to its production (BC Ministry of Agriculture 2012b). In fact, the extent of land devoted to the industry has been increasing steadily over the last 20 years, with a growth of 44% between the 1991 and 2006 (BC Ministry of Agriculture and Lands 2007).

Moreover, this growth was concentrated in the Lower Fraser Valley, where 97% of the province's blueberry production takes place. While the acreage in blueberries is dwarfed by hay and field crops in the province, it is significantly greater than the area in grapes (9,170 acres) or field vegetables (16,287 acres), with 23,270 acres in the Lower Fraser Valley alone (Ministry of Agriculture map, 2015 (BC Ministry of Agriculture 2012c). This accounts for at least 9% of total farmland area in the Lower Fraser Valley.

A variety of interacting economic forces contributed to land use change that resulted in the concentration of blueberry agriculture in the Lower Mainland that we see today. First, BC farmers were under pressure due to increased competition in the international market, especially after the NAFTA agreement was signed in 1994. Unable to compete with the cheap production of field vegetables and strawberries occurring in California and Mexico, and with the closure of several large vegetable processing facilities in the Fraser Valley region in the 1990's, farmers were primed for a transition and looking to capitalize on new opportunities (Fraser 2006; Rice 2014). This economic stress on farmers occurred around the same time that blueberries began gaining international recognition for a variety of health benefits. Researchers found evidence that blueberry supplements could reverse age-related neurodegenerative disease because of their antioxidant content (Joseph et al. 1999). Following this discovery, an increasing number of studies (e.g. Castrejón et al. 2008; Giovanelli & Buratti 2009; Pranprawit et al. 2015) and news articles were published that framed blueberries as a 'super fruit' with numerous health benefits, primarily due to antioxidant content. Demand for blueberries increased as a result, and markets responded: prices began increasing in the late 1990s, and in 2006 they peaked at $1.19 per pound.

International markets and trade have significant impacts on farmer choices (Fraser 2006), and with pre-existing economic stress caused by competition with US production, combined with the growing demand and high price of blueberries, and the suitability of local growing conditions, many farmers responded by converting to the crop. Indeed, during this 'boom' in the blueberry market between 2002 and 2006, farmers were making good returns on their investment (Yang 2010). However, following this peak in 2006, prices for blueberries declined as the market was flooded with production from within Canada as well as the Unites States, and growing markets in Chile and China (Garr 2009; Yang 2010). With the oversupply of blueberries, the market fell into bust, and in 2009 prices fell to 1990 levels.

Despite this decline in price, expansion of blueberry acreage continued consistently (see Figure 3). There are several potential reasons for this, including the hope held by farmers that prices will recover and that there will be another boom for the industry, or a market "correction" (Garr 2009).

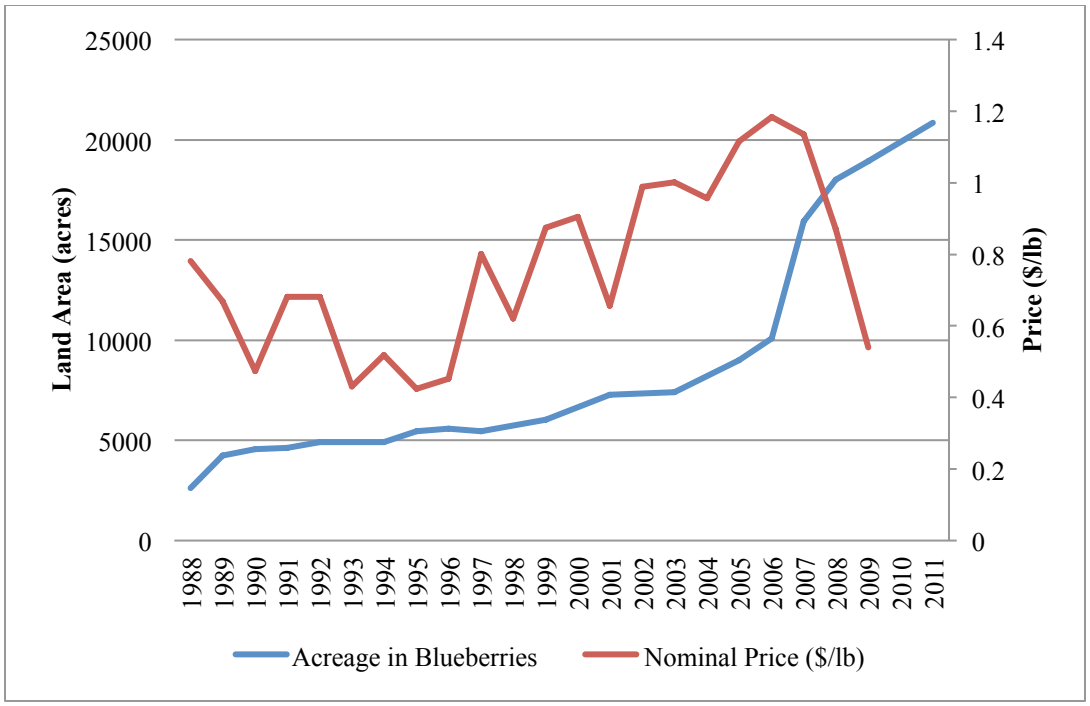

Figure 3. Changes in Blueberry Acreage in BC Relative to Price (1988-2011)
The changes in land area devoted to blueberry production (in acres) in BC relative to the nominal price of the commodity in Canada (in dollars per pound) between 1988 and 2011. Demonstrates the continued increase in land acreage for blueberries even following a significant collapse in price between 2006 and 2009. (Data sourced from Statistics Canada and Yang 2010).

Underlying the market-induced transformation of the industry is the physiology of the blueberry plant itself, and its implications for the adaptability of blueberry agriculture and farmers in the long term. As a perennial shrub, blueberry bushes do not produce fruit during the first season after planting; as such, converting land to the perennial crop is a long-term investment. Moreover, the plant requires more time to mature than other berry crops. Relative to raspberries, which will produce a crop in two years, blueberries do not fruit until their third year after planting, and don't reach full production levels until a decade after planting (Garr 2009). They also have very particular requirements for inputs and growing conditions – they require an acidic soil that is rich in organic matter and extremely well drained. In order to hold moisture close to the shallow root system, it is essential to grow the shrubs with a layer of mulch in the

form of wood chips or other organic material (Strik 2013). While originally blueberry production was limited to acidic peat soils, which have a low pH and significant moisture-holding capacity, developments in cultivation techniques and soil amendments have allowed cultivation of blueberries to proliferate in nearly any soil type (BC Ministry of Agriculture 2016).

The increased acreage in blueberries has also been driven by investment in the BC real estate market, from both on and offshore, and blueberries have provided the ideal pathway to the tax break associated with farm status because of their ease of management (Gordon 2016). Because of the lag time between investment and production for the crop, as well as the unique requirements for growing conditions, blueberry growers are not likely to transition to another crop quickly or easily. As the bushes planted during the blueberry boom begin to reach peak production, both local and global production will continue to increase, further saturating the market.

While the extent of blueberry agriculture is significant, the modes of production are not homogenous. Currently, farms in the Lower Fraser Valley of British Columbia range in production modes from smaller-scale diversified and organic farms to export-oriented, large-scale production (BC Blueberry Council, 2009). This diversified structure, combined with the overall economic and ecological significance of the blueberry industry in terms of agrarian transformation in a regional setting make it an ideal setting to explore pathways and barriers to food sovereignty. While blueberries are not a staple crop nor provide a substantial number of calories to any given population, the export-oriented industry is representative of Canada's current agricultural paradigm and market-driven industry trends, and thus an analysis of processes and outcomes in the sector and how they contribute to equity, empowerment and ecology in the industry will be relevant for future assessments in other production systems.

Understanding how the principles of food sovereignty are (or are not) expressed in this commodity-specific context will provide key insights for food sovereignty assessment of other commodities, and help to operationalize a framework for looking at the intersection of socio-political and ecological dynamics and how they interact at multiple scales.

3.3.2 The State of Food Sovereignty in BC Blueberry Production

While blueberry production represents a distinct sector within the BC agricultural system, it is important to understand the interactions between this sector as nested within the broader dynamics related to equity, empowerment and ecology as outlined in section 3.2, in addition to the discussion in this section regarding industry growth and characteristics. Like most current and potential farmers in the Fraser Valley, blueberry growers are heavily affected by the high costs of land and productive resources in the region. As the growers who participated in this research have succeeded in accessing these productive resources (though for many this was a significant challenge), these costs are mostly acting as financial constraints on their choices. As such, the way that these costs constrain grower choices will be operationalized as a process of economic disempowerment based on the conceptual framework outlined in Section 2.1.

The extent to which the health in-equities outlined in Section 3.2 are exemplary of the blueberry industry cannot be concluded, as these studies include data from various sectors in the Fraser Valley and across the province. However, as blueberry growers are drawing from labour pools through farm labour contractors as well as the federal SAWP to meet demands for seasonal labour, it is reasonable to assume that these problematic labour arrangements also occur in this industry (BC Federation of Labour 2004), and there is sufficient evidence to conclude that many

workers on blueberry farms experience unhealthy and unsafe work environments (Weiler et al. 2016; Otero & Preibisch 2010; Macdonald 2007).

Based on existing research and reports regarding the blueberry supply chain, commodity groups, and government programs, political and economic empowerment for blueberry growers is complex. The blueberry sector has been heavily influenced by changes induced by agricultural free trade agreements (as outlined in this section), and combined with the foreclosure/collapse of the blueberry co-op in 1997, many growers who had the capacity to expand decided to vertically integrate, resulting in the current structure of the industry (to be discussed further in Chapter 4). It has been suspected that the strong presence of packers in the industry contributing to lack of profit for growers (Gordon 2016), reflective of provincial and national dynamics surrounding state support for processing and the decline of GDP contributions from primary agriculture in the food system (Agriculture and Agri-Food Canada 2016).

On the other hand, there are several institutions in the industry that provide support for growers in the form of knowledge and technical assistance, and could be considered politically empowering as they mobilize knowledge and resources and provide an avenue for participation for growers. The BC Blueberry Council (BCBC) is a commodity-specific group that represents interests of growers internationally and serves as marketing platform, in addition to providing field expertise through pest monitoring and reports, communication regarding relevant policy changes, and research and development into varietals and management practices (BC Blueberry Council 2009b). While earlier research has highlighted the lack of accessible safety materials for growers and workers (specifically materials in Punjabi, which spoken by a large proportion of agricultural workers in the province), the BCBC has published resources online in Japanese, Mandarin, and Punjabi, and has made health and safety materials accessible in Punjabi and

Spanish at their field day events. In addition, the Ministry of Agriculture provides targeted support to blueberry growers through their berry specialist, an industry representative that works closely with growers and the BCBC as horticultural support.

Climate change, pest pressures, soil and water issues, and pollination all present major challenges to ecological resilience of blueberry production in the Lower Fraser Valley. Climate change promises to introduce many new stresses on the blueberry industry in BC, as well as the agricultural system more broadly. Some bio-physical threats have already begun to place pressure on the industry; for instance, recent warming trends have caused the blueberry crop to flower early, resulting in potential phenological problems with pollination as well as extreme risk of losing the crop if a spring cold snap were to occur (Fumano 2015). Research has demonstrated that poor weather conditions during flowering decrease the effectiveness of pollination of blueberries, particularly for honeybees (Tuell & Isaacs 2010). Pollination in the blueberry industry is valued at $100,989,000, which is the highest value of pollination for a single crop in the province (BC Ministry of Agriculture 2015a). Considering the high dependence on insect pollinators (100%), and the proportion of pollination from honeybees estimated for the crop (90%), honeybees are paramount to the success of the blueberry industry. Yet, several studies have assessed pollination rates and pollinator populations in the commercial blueberry industry in the Pacific Northwest, and have concluded that a combination of both native and managed bee populations is optimal to ensure adequate and sustainable pollination rates of highbush blueberries (Courcelles et al. 2013; Benjamin & Winfree 2014). As such, growers need to not only hire apiarists to bring in their managed colonies, but should also ensure the availability, diversity and abundance of flowering plants will be crucial for fostering a thriving population of pollinators.

Additional challenges that characterize the state of ecological resilience in the blueberry industry involve soil, water and pests. As a perennial crop, blueberry shrubs require no tillage or annual planting, however, soil compacting and nutrient losses remain a significant challenge for growers, and threaten the health of surrounding ecosystems (BC Ministry of Agriculture 2014b). Additionally, climate change promises increasing exposures to storm surge flooding, variable hydrological conditions, and salinization in the high-producing berry regions of the Fraser Delta (Crawford & Beveridge 2013). However, the ecological threat of most immediate concern facing the industry is the growing risk of crop damage from pest outbreaks. Pest threats are causing growers to resort to pesticide treatments in order to prevent, suppress and eradicate these issues in order to minimize losses. The spotted winged drosophila (SWD) is a pest of berry and stone fruits that is already causing significant economic damage to berry crops in the Pacific Northwest of the United States and in BC (Hueppelsheuser & Sim 2014; Bolda et al. 2010; Walsh et al. 2011), and there are other pests and diseases that growers have already been contending with in the area for several years (BC Ministry of Agriculture 2016).

In summary, there are various ecological dynamics that threaten both current production and the stability and viability of long-term agricultural capacity in the region. The way that growers are managing and reacting to these challenges, how these responses are shaped by additional social and economic dynamics, and how they interact with equity and empowerment in the industry, are of particular interest in this study.

Chapter 4. Methodology

4.1 Gaps in Understanding of the Blueberry Industry

The previous section reviews the current state of knowledge about how some of the principles of food sovereignty are currently represented in the BC agricultural sector. As export oriented industries are not generally studied in the food sovereignty literature, our current understanding of food sovereignty as a whole and the particular social, political and ecological dynamics highlighted using such a framework is limited in the particular context of blueberry sector in BC. However, the synthesis of the scholarship in the previous section illuminates several aspects of food sovereignty in the landscape of blueberry production: labour and health inequity among farm workers, economic dis-empowerment of producers, and growing ecological challenges both caused and faced by producers.

Yet, as the individuals who are making farm and business management decisions while negotiating tensions between political inclusion, identity, larger political economy and cultural dynamics (Burton 2014), the experiences of growers matter for our understanding of whether food sovereignty principles can be achieved in the context of an industrialized and globally integrated sector. Growers are principal actors at the nexus of interactions with workers, markets, processors and the environment; as such, this stakeholder group represents a strategic point of entry for our understanding of the system. Figure 4 is a conceptual representation of the principal stakeholder groups based on an initial characterization of the industry, and highlights the pressures, risks and constraints experienced by each group.

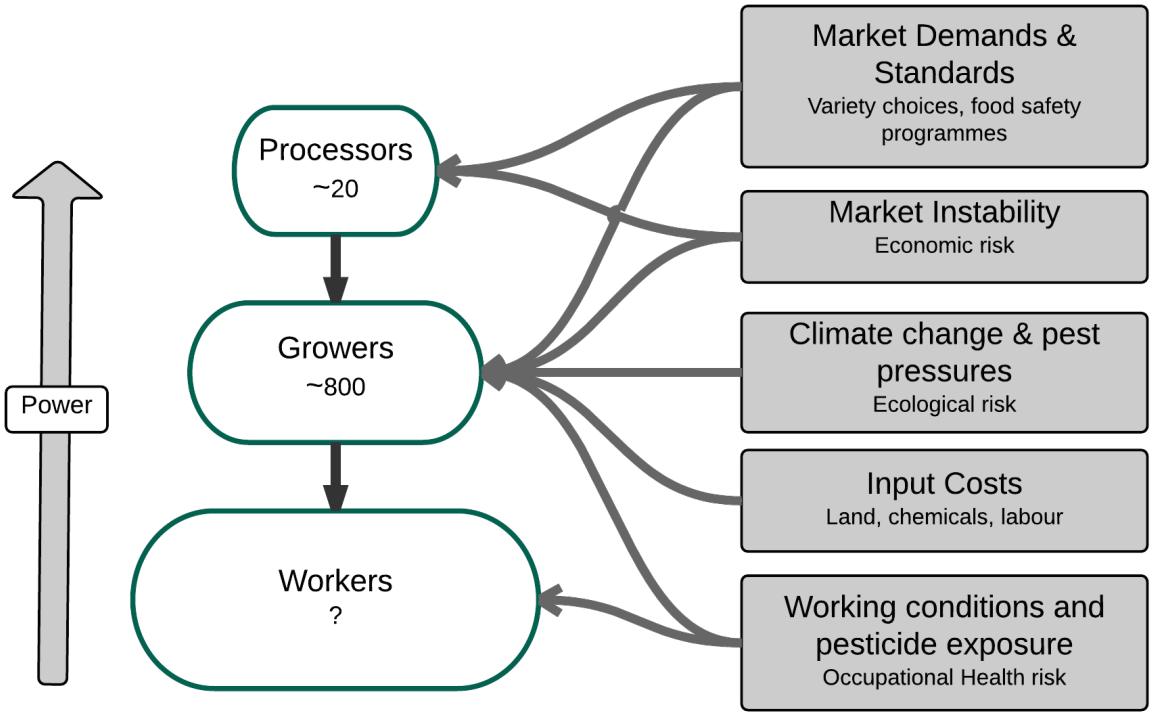

Figure 4. Characterization of Principal Stakeholder Groups and Power Dynamics in the BC Blueberry Industry
Demonstrates the size of each stakeholder group (white ovals). The arrows indicate the various risks, constraints and pressures experienced by each stakeholder groups. The estimated numbers of processors and growers in the industry were retrieved from the BCBC. There is no existing estimate for total farmworker population in the BC blueberry industry.

While isolating any one stakeholder or aspect of food sovereignty is contrary to the systemic and context-dependent nature of the food sovereignty framework, an in-depth understanding of the choices, motivations, and perceptions of growers will further our analysis of socio-ecological dynamics in this particular sector, as well as significantly inform our understanding of food sovereignty dynamics in export-oriented supply chains around the world.

In order to address current knowledge gaps regarding pathways and barriers to food sovereignty in the blueberry industry, we investigated the following sub-questions:

- Why are growers choosing to grow export crops?

- Which production models are they using and why?
- How do they perceive their interactions with other parts of the food system?
- How do growers interact with issues relating to equity, empowerment and ecology?
- Who are the winners and losers within a particular sector, in relation to equity, empowerment, and ecology?

4.2 Indications of Food Sovereignty: Blueberry Grower Focused

In order to better understand growers' experiences of different aspects of food sovereignty in relation to the food system, I drew from political ecology approaches to understanding multi-scalar linkages in the food system. The extensive body of food sovereignty scholarship and literature provided a nuanced framework with which to approach the assessment of the blueberry sector as a complex socio-ecological system with a focus on social and political facets.

There is great synergy (and indeed, overlap) between the study of political ecology and the concept of food sovereignty. Both encompass concepts and principles from bio-physical and social sciences, and place great importance on ecological outcomes in relation to social systems. They also both emphasize the multi-scalar and nested nature of food systems, acknowledging not only that the farm is a part of a community, territory and country in the geographic sense, but also that farmers' experiences are shaped by larger scale relations and interactions in a cultural and institutional sense. This synergy is of particular importance when assessing food sovereignty pathways and barriers in the blueberry industry as it facilitates the investigation of the ways in which behaviour and decisions of farmers are mediated by institutional, cultural, and economic

constraints. This research seeks to empirically evaluate these various dynamics and interactions of various elements of the food system.

In order to operationalize the concept of food sovereignty into an analytical framework, identified and operationalized key variables and principles, and determined criteria to reflect the various pillars of the food sovereignty framework. I conducted a literature review of existing food sovereignty indicator frameworks, as well as other disciplines and areas of research that overlapped with food sovereignty pillars, such as indicators of agricultural sustainability.

Sometimes also referred to as attributes or metrics, indicators can be used to assess the achievement of an environmental, social or economic objective or criteria. As such, they can be used to break down complexity into various essential components, as would a model, allowing researchers to examine specific relationships, interactions or trends in the system. Bockstaller & Girardin discuss how an indicator can have an informative function, when the indicator can supply simplified information that may otherwise be difficult to assess, and an outcome function if the indicator can measure the achievement of certain objectives and assist in making decisions (Bockstaller & Girardin 2003). As such, indicators, when properly selected, can help researchers garner important information and assess processes and outcomes in a complex system.

One way of distinguishing between the functions of an indicator is whether it is evaluating or monitoring a process (a process indicator), or whether it is measuring the achievement of an outcome (an outcome indicator). Process indicators are used to monitor an action or measure that is associated with an outcome of interest, for example, monitoring pesticide usage (process) as an indicator of environmental contamination (outcome). An outcome indicator can be used to measure the effectiveness of process, or the state of a given system or criteria, such as the impacts of a farm to school program (process) on child nutrition while in

schools (outcome) (Harley et al. 2008). These two classifications of indicators are also sometimes referred to as means-based versus outcome-based (Binder et al. 2010).

It should be clarified that every 'thing', which includes every indicator, is the outcome of something else. In the same sense, every indicator could be considered a process that leads towards a particular outcome. For example, a healthy diet is both a process that leads to general health and wellbeing, but it is also the outcome of several influential factors or "determinants", such as social and economic access to healthy food, and cultural preferences. As such, the frame of reference or analysis is often what dictates whether a given indicator is to be considered a process or outcome, as it depends on what you are most interested in examining in your system. In systems thinking, this is similar to defining your scale and boundaries of the system.

Additionally, there are benefits and challenges associated with both types of indicator. For a process indicator to be most useful and informative, it must be sufficiently associated with a given outcome (Mant 2001). In other words, process indicators are only useful insofar as they can be linked to the outcome of interest. For outcome indicators, this can also pose a challenge, as there may be several processes leading to a single outcome, so if your objective is to associate a given outcome (e.g. biodiversity loss) with a particular process (e.g. intensive agriculture), attributing this outcome to that process of interest is crucial for the indicator to meet your objective.

Another way of conceptualizing the different types of information that can be communicated by indicators is using the Pressure-State-Response (PSR) system (VanLoon et al. 2005). In this approach, indicators are divided into three categories: (1) pressure indicators that show a potential or actual stress that could lead to problems, (2) state indicators measure a condition in the system at a particular point in time, and (3) response indicators describe a

process or measure being used to alleviate a given stress or improve an adverse situation. Under this distinction, pressure and response indicators would fall under the 'process' category, as they describe either a potential stress (process) that could lead to a problem (outcome), or a measure (process) being implemented to alleviate that problem (outcome). A state indicator is simply a measurement of that outcome. Regardless of the distinction used to classify types of indicators, to conduct a comprehensive evaluation it is ideal to include all or both types of indicators (Mant 2001; VanLoon et al. 2005; Harley et al. 2008).

4.3 Hypothesis: What Would Food Sovereignty in the BC Blueberry Industry Look Like?

In order to provide a logical frame with which to assess food sovereignty within a particular context, it is helpful to conceptualize how food sovereignty principles might be exhibited in the blueberry industry, and what it might look like when equity, empowerment and ecology are exemplified by and facilitated in the system. Drawing from food sovereignty scholarship, but also documents from the BCBC, the commodity association that represents growers in the province, we ask: what would a 'food sovereign' blueberry sector look like? The parameters for what an ideal 'food sovereign' blueberry industry might look like provide a frame of reference and a hypothesis that we can test through the use of indicators.

The initial food sovereignty literature review yielded a preliminary portfolio of more than 100 indicators.[3] This was then narrowed down to 55 key indicators spanning 19 variables of interest based on a review of literature on the blueberry industry, consultations with industry representatives, and feasibility of implementation given the timeline and expertise of the research

[3] The process to identify and select indicators was undertaken in collaboration with the Think, Eat and Grow Green Globally (TEG3) project and its partners in Ecuador.

team (see Appendix B for full table of indicators). Table 1 describes what the hypothesized determinants of food sovereignty would look like in the blueberry industry, and the translation to the variables and indicators used to assess equity, empowerment and ecology in the blueberry industry.

Table 1. Conceptualization of Hypothesized and Operationalized Indicators of Food Sovereignty Principles
Hypothesized indicators of equity, empowerment and ecology and the associated variables selected to examine processes and principles with growers in the blueberry industry.

	Hypothesized Indicator of Food Sovereignty	**Operationalized Variables of Interest**
Equity	Growers have equitable access to productive resources such as land, inputs, etc.	• Land tenure arrangement • Major operating costs
	All workers, regardless of race, gender, or occupation, are paid a living wage, with fair labour conditions, including adequate access to healthcare and other benefits. Growers should also have fair and good working conditions	• Wages paid to workers • Occupational health and safety protocols • Access and use of protective equipment • Social demographics of farm workers and operators
	Producers who are able to earn an income from growing food full-time (if they desire to), without resorting to self-exploitation or unpaid labour	• Off-farm income • Reason for off-farm income • Informal or un-paid labour arrangements
	Industry/institutional supports are not disproportionately offered to certain groups or types of farming operations	• Institutional support in the form of financial supports, information, tools, etc.
Empowerment	Growers are able to participate in and have influence over decisions made regarding their livelihoods	• Extent of participation in socio-political governance processes • Perception of value of that participation • Perception of empowerment through this participation
	Strong/attractive livelihoods and lifestyles; Growers are able to make autonomous choices about how they want to participate in the food system in terms of growing practices, and market channels	• Level of satisfaction with income from agriculture • Factors that affect decision-making about livelihoods and farm business • Preferred and actual market channels used
Ecology	Resilience to disturbances and change such as disease, drought tolerance, variable climatic conditions	• Agrobiodiversity on farm (cultivated and non-cultivated) • Blueberry varietal diversity and selection

Hypothesized Indicator of Food Sovereignty	Operationalized Variables of Interest
Minimizing dependence on pesticides in the industry through the use of alternative growing methods and Integrated Pest Management (IPM) strategies	• Use of IPM strategies • Extent of use of synthetic and organic pesticides
Use of practices that conserve soil and restore soil quality	• Frequency of best management practices for soil (e.g. mulching, composting) • Presence of windbreaks and shelterbelts to prevent erosion • Whether or not growers used soil tests to determine nutrient inputs • Other practices that enhance soil quality
Reducing dependence on inputs through recycling of nutrients, best management practices, and the judicious use of all resources including nutrient inputs and fresh water	• Source and types of inputs used (if any) • Type of irrigation system used (if any) • Other practices that recycle nutrients
Growing practices that both ensure adequate pollination and support healthy pollinator populations, and reduce dependence on and risk for managed honeybee colonies (e.g. biodiversity in flowering plants and habitat, growers keeping their own bees as opposed to increased exposure to diseases due to connectivity)	• Presence and extent of pollinator habitat • Whether or not wild pollinators were observed • Future plans to enhance wild pollinator populations • Whether or not growers keep managed bees • Concentration of rented hives during flowering events

The portfolio of indicators underwent preliminary design validation throughout the fall of 2014 through consultations with local farmers, food systems researchers and industry representatives, and a review of previous studies and existing integrative indicator frameworks in order to ensure their utility and applicability to the BC context (Bockstaller & Girardin 2003; Keeney & Gregory 2005; Bockstaller et al. 2009; Andersen et al. 2013; Binder et al. 2010).

The resulting set of indicators and questions can be categorized within the following thematic areas: (1) production characteristics, (2) agrobiodiversity, (3) business model and

supply chain, (4) institutions and networks, (5) labour and occupational health, and (6) grower livelihoods. The examination of variables of interest within each of these categories, their relationship to each other, and their implications for equity, empowerment and ecology provide the conceptual basis for the commodity-specific assessment of food sovereignty conducted in this paper (Figure 4).

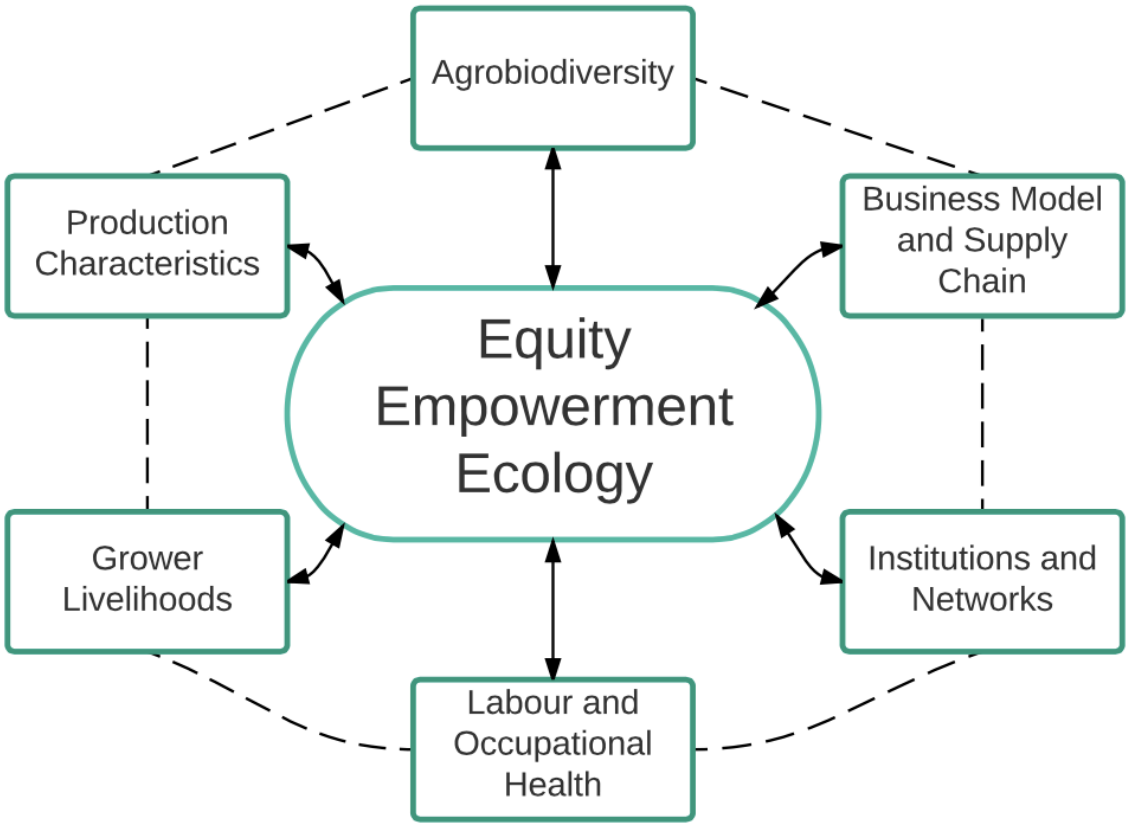

Figure 5. Conceptual Representation of Food Sovereignty Framework and Themes of Interest within the BC Blueberry Sector

For example, land tenure arrangements can be important indicators of food sovereignty as these mechanisms mediate the degree of access, control and autonomy that an individual or

community may have over their agricultural production system. As such, type of land tenure agreement is one categorical indicator explored in this analysis, as well as the conditions of this agreement, and the perceived benefits and challenges of these systems according to growers.

4.4 Data Collection: Grower Interviews

I collected my data between September 2015 and February 2016 in the Lower Fraser Valley in Southern British Columbia. I conducted 33 structured interviews with growers at the location of their choice, which was often on their farms or in their homes. Two interviews were conducted by phone. I also conducted participant observation at two field days organized by the BC Blueberry Council. The data collection instrument consisted of a mixture of structured and open-ended questions, and covered a variety of topics based on the conceptual framework discussed previously, including, but not limited to: land access, participation and support from various institutions, agricultural management practices in the field, labour practices, and market integration. Questions were based on quantitative and qualitative indicators: the former allowed for the collection of concrete categorical and numerical data to provide the basis for comparison between farms, while the qualitative data allows for a more in-depth understanding of context, meaning and reasoning used by participants.

There were 33 blueberry growers and their farms included in this study, representing a range of scales and modes of production. This sample of 33 growers accounts for 4% of the grower population in the province (there are an estimated 800 growers in BC the total acreage represented in this sample accounts for nearly 8% of the province's blueberry acreage (BC Blueberry Council 2009a). Five participants were vertically integrated and had a packing/processing facility as part of their business model. There are approximately 20

packer/processors in the province of BC (referred to as processors hereafter). Within this sample, farm size (acreage in blueberries) ranged from 1-350 acres. The average total acreage in production was 55.4 acres, and the average acreage in blueberries was 49.6 acres. 1/3 of farms included in this study had all or some of their production certified organic (8 were fully certified, 1 was in transition, and 2 were part-certified), and the remaining 22 growers had conventional production modes. This delineation between organic and conventional should be accompanied with some circumspection, however, as some growers who used alternative methods and no pesticides (synthetic or organic) were not certified organic, and others using input-intensive methods had organic certification. I will return to this discussion of input substitution and farm stratification in Chapter 6. The sampling strategy was purposive in order to target farms and growers that represented the diversity in production types present in the industry.

4.5 Data Analysis

Qualitative interview data was analyzed using a thematic coding procedure in NVivo for both pre-determined themes of interest related to specified food sovereignty indicators as well as emergent themes. I used NVivo to categorize and explore linkages between themes, and reported on themes most commonly mentioned by participants. Quantitative responses to structured survey questions were analyzed to calculate descriptive statistics including comparisons between different groups of participants based on growing practises, farm size, and other characteristics. This data was also used to corroborate findings from qualitative analysis, and determine the degree to which views expressed by individual participants were representative of larger trends within this sample of blueberry growers. Data on farm characteristics and field management practices were used analytically to classify and situate participants and their respective operations along the spectrum of ‘conventional’, ‘organic’, and/or ‘alternative’ modes of

production. A discussion based on this analytical exercise is included in Section 6.3. Tableau and Excel software were also used for visual exploration of quantitative data based on stakeholder categories and farm size. The majority of this quantitative data is reported in Appendix C.

The following section will provide an overview of the results of interviews with growers focusing on the dominant themes from grower interviews in relation to the determinants of food sovereignty: (1) Labour and mechanization, (2) Livelihoods and lifestyles, and (3) Distributions of power. A more complete presentation of results from the food sovereignty indicator assessment is presented in Appendix C.

Chapter 5 will present results from the indicator assessment, followed by a synthetic discussion of how these themes inform our understanding of equity, empowerment and ecology, and the processes supporting and barriers to food sovereignty exemplified in this industry in Chapter 6. It should be noted that this framework was used iteratively, and some indicators informed our understanding of multiple dynamics. This was particularly the case with regards to the more nuanced qualitative discussions of decision-making, values, and socio-political participation, and the reasoning used by participants. For example, farm operational costs were investigated in order to garner insight regarding productive equity on farms, but growers brought up costs frequently as a constraint that affected their decision-making regarding agricultural practices and general farm management decisions.

Chapter 5. Results: Principles and Processes for Food Sovereignty

This chapter highlights the dominant themes and dynamics as expressed by growers during interviews. The results presented here are not exhaustive of all themes related to equity, empowerment and ecology in the industry, nor is this a comprehensive presentation of all data collected for this research project (see Appendix C for a more complete presentation of indicator results). Rather, the results presented here were selected based on the frequency with which these challenges were discussed, and the importance that growers placed on these aspects of their experiences. The focus on these themes allowed a more in-depth exploration of the ways that different dynamics and pressures interacted in complex ways, and the varying perspectives of participants with regards to different elements of the blueberry industry. The following themes will be discussed in this chapter: (1) labour and mechanization, (2) livelihoods and lifestyles, and (3) distributions of power. Section 6 will relate these results to principles and processes of food sovereignty, and situate these findings within the literature.

5.1 Labour and Mechanization

Growers discussed finding sufficient and affordable labour as one of the biggest challenges facing the blueberry industry. Most growers framed this as a labour shortage, particularly for harvesting labour. Due to the concentration of the blueberry industry in the Lower Fraser Valley and the seasonal nature of the crop (varieties are ready for harvest between June and September, with a peak in July/August), the demand for labour is also concentrated in a small area and short time period when berries are ready to be harvested. Some growers identified a major challenge with respect to finding labour isn't strictly about the shortage of supply, but the quality of the job itself not being satisfactory considering remuneration:

> *Contract workers [workers hired through a farm labour contractor] are hired for pruning. For pruning it's pretty well all men, Indian immigrants, all basically seniors. Some of the guys have been with us 20 years. Great guys - I love them like my own uncles or parents. But young, able-bodied people don't want to come into the fields. It's not even about wages, it's about conditions. I had guys coming in for 30 bucks an hour and after a few hours they're like 'screw you I'm going elsewhere'. Who wants to be out there in cold, wet weather or hot and dry? I mean if they can get a job in a factory or wherever else even if its less wages, I'd rather work there...* – Grower 24

In addition to the challenges associated with finding sufficient labour, most growers also discussed the cost of labour as being a barrier for farm viability, and a constraint that influences decisions made about the farm business. Of the farms that reported the distribution of their farm operating costs, labour represented on average 49% of operational costs (15 of 33 growers reporting)[4]. 17 of 33 growers stated that labour was their most significant cost.

> *You can take 600 dollars [per acre] for chemicals and fertilizer, the labour part [would be] close to 4-5,000 if you pick by hand, rent which is 2000, and you end up with negative. Those are the numbers. I know the numbers. I have a lot of experience in different regions of growing blueberries. We can't compete with other countries like Mexico, Argentina, and Chile. So the only way you can survive is by machine harvest. If you machine harvest then your costs get down to probably 1200-2000. – Grower 17*

The combination of a perceived labour shortage and high costs of labour relative to their price for berries has elicited a transition towards mechanization for many growers. The decision to mechanize was perceived by some to be the only way to maintain a viable business in the face of rising costs and relatively low prices.

[4] This is likely to be an underestimation as some growers did not include their own salary or labour in this calculation

Before I do hand pick and now I do machine pick. Because of [the shortage] of labour - I cannot pick at the right time and if I pick late my quality goes down and I can't get paid by the processing plant. – Grower 25

It's very hard to get pickers nowadays. And they want 65 cents [per pound] or whatever and if you're getting 80 or 90 cents or like last year, 70 cents, you're not making anything. …With the contractors showing up "I'll bring you 60 [workers]" and he brings you 15. And the next day it might be 30 and then 60, and you can't plan the harvest of your field doing that. [With mechanization] I love it – let's go [voom]! – Grower 8

When you look 10 years ago, we just dealt with a labour contractor. We just had the pickers coming in. Most of them are 65-year-old women and 75-year-old men. That was 10 years ago. So they have either retired, or they are now 75 and 80. And the younger kids don't want to. 15 years ago they didn't want to! 'I'm not going to go out and do that I could work at McDonalds and make more money!' So I think labour is definitely going to be an issue. So a lot of the farms now are saying "I don't deal with labour. We machine pick everything." Because they just don't want to deal with labourers. What you actually harvest goes down - you lose 20% on the ground - but your costs go down. –Grower 26

These quotes highlight some of the ways that the significant decreases in operational costs associated with mechanization outweighed the trade-offs with production losses (mentioned in the quote from Grower 26). Apart from the enhanced business viability from mechanization, there are several other indirect consequences of increased rates of mechanization that have economic and ecological implications for growers and for the industry itself (refer to Chapter 4 for a more comprehensive discussion of these implications). Growers identified many of these during interviews, including contributing to market saturation, increasing waste and loss during harvesting, and decreasing varietal diversity.

But that [begs] a question - if everybody got their machines out, what is going to happen? There is going to be a significant percentage that goes into the frozen market. I mean our whole big support mechanism has been the fresh market… Because only 4 years ago it was a 60/40 split fresh processed and now it's the other way around and so that number is only going to climb, so that puts additional stress on the industry. But that

> *just gives you the trend of what's happening. We as an industry, we need to, through breeding etc., develop varieties that [can be] mechanically harvested. Because at the end of the day, the labour isn't there. A lot of our Mexican labour, we can't use them for hand harvesting because we can't pay them a piece rate, we have to pay them hourly, and so that's not justified.* – G013

> *With having Dukes [variety name] we can get them picked without putting on any insecticide. Because we have more pickers in the field, and we pick up to date always, and the fruit is never left to hang. And because of that we stay ahead of that pest and if we need to we do use an organic insecticide, but basically it's the picking process that works.* – G019

These perspectives illustrate the ways that increased use of machines for picking can impact the market, as the use of machinery on many varieties means they have to be sold in the frozen or processed market. Berries that enter the processed market are also sold at a lower price as opposed to those sold fresh, yet this loss was still worthwhile to growers due to the money saved by hiring picking labour. The second quote from a grower also highlights how labour and pest challenges are linked in this industry, and the associated labour challenges with integrated pest management approaches.

Participants echoed challenges with finding affordable and adequate labour consistently, but there were a few growers who discussed some innovative/alternative approaches to overcoming their difficulties finding appropriate and affordable labour.

> *Labour shortages are a big problem – but we're trying a new model to avoid hiring temporary foreign workers by hiring through an organization that works with mentally disabled folks. So we hired through them last season and it worked well. We had 10 at the beginning of the season and 5 or so stayed on. Some of them were very good pickers - one was a 'power picker' even.* – Grower 1

> *[I hire] Local kids - all teenagers - they come every year. I call myself a coach or a team leader... I pay more than minimum wage because I believe people should be compensated for what they do and I also want to motivate young people to work.* – Grower 27

While these few instances of growers actively choosing to find labour in unconventional ways, these growers themselves recognized that this was outside the norm, and some expressed the significant time and effort invested in these alternative pathways to hiring workers. The majority of workers hired among participants in this study were from visible minorities, and many were hired through farm labour contractors or the SAWP.

Another important dynamic that was expressed by growers, particularly those that were also engaged or aware of the processing industry, is the sense that the growers in BC are now part of a global commodity network with high rates of competition.

> *During the season here, blueberries were harvested, they went in either to fresh or into the freezer. And all winter long inventory was just picked out. And it was consistent. You made money. Then what happened - 10 years ago - Chile starts planting. They're on another crop cycle! So now, you put the blueberries in the freezer in August, you better sell them by November because Chile is coming on. And their fresh berries are coming in. All winter long - December, January, February, is Chile. Did Florida ever have blueberries? No. But now Florida starts coming on in April. And Georgia and all those areas start coming on in May. So your shoulder season has just shrunk down. And again, you've got yours in the freezer in September, so does Chile! Theirs are from the year before. And Chile is cheaper. So we're a global market now. Again 15 years ago, did they fly fresh cherries around the world? no! Did they fly blueberries in from New Zealand or Chile, no! But now we fly them anywhere. We think nothing of it... I'll even do it! We've shipped juice in a container to Hong Kong, just to get them there. – Grower 26*

Many growers expressed the idea that BC blueberry growers are relatively disadvantaged in the global marketplace due to high costs of labour and productive inputs, and that trade networks have opened up the local market to a flood of imported berries from other regions with lower cost and higher quality. These challenges with high cost and a low market price contribute to the

move toward mechanization, and the inability to pay labourers more money at the risk of jeopardizing business viability.

5.2 Livelihoods and Lifestyle

Another commonality between participants that seemed to have significant implications for their business models and the industry more generally was the dependence on off-farm income to support the farm business and household. 29 of 33 farms (question referred to household or farm unit income) have had significant off-farm income that has supported their farming business (see Figure 6). Many growers relied on this off-farm income to pay off their mortgage and for initial capital investments (e.g. planting, machinery, irrigation infrastructure). When asked about their household or farm unit's *current* proportion of income from agriculture, the majority of participants reported receiving at least half of their income from off-farm sources. 23 of 33 were getting equal to or less than 50% of their income from agriculture generally, and 9 of 33 were getting 2% or less from blueberries.

> *[I work off-farm] by necessity. I could never live on what the farm earns me.* – G021

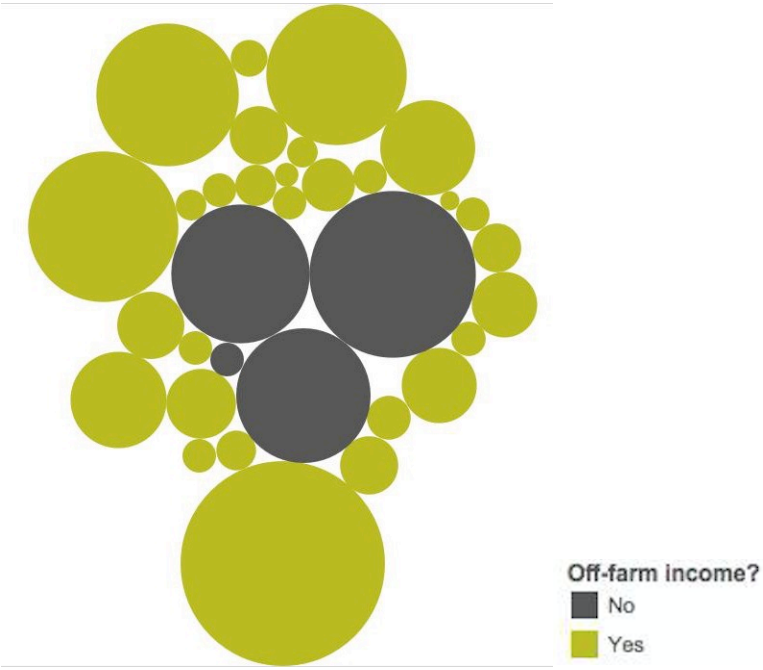

Figure 6. Visualization of Off-farm Income and Farm Size
Indicates farm households who have had significant off-farm income to support their farm (yellow) and those who have not (grey). The size of circle indicates farm size by total acreage in production. This was done to explore whether larger farms relied less on off-farm income due to achieving economies of scale, but this figure indicates no relationship between the two variables. 29 of 33 farms have had significant off-farm income to support their farming business. Of these, 2 farm units are also vertically integrated and have a processing facility, and reported getting most of their income from the processing side (vertical integration is discussed further in section 5.3).

One unanticipated finding from this study was the relationship between this level of off-farm income and the choice of growing blueberries as a commodity crop. When asked whether their off-farm work was engaged in by choice or by necessity, many growers expressed that their off-farm work was both by choice and necessity (or neither), as their various professions off-the farm are what enabled them to have the farming lifestyle that they wanted, and that these professional vocations pre-dated, in many cases, their farm business.

> *What attracted me to farming was personal choice. [It's] the kind of environment where I want to raise the kids. It's a lifestyle that I choose for myself. And I am a bit of a*

> *workaholic and it gives me something to do all the time, plus be at home and be close to the family. Partly what I do [for work] other than [farming] as well… balance out the lifestyle*. – Grower12

Further, participants viewed agriculture generally (and blueberry agriculture, specifically) as being about lifestyle: 10 of 31 participants discussed lifestyle as an influence on their farm-related decisions. When asked about their motivation to plant blueberries, 14 of 31 growers said they were attracted to blueberries by the ease of management. Many growers framed their participation in the blueberry industry as a 'means to an end' of having the farming "lifestyle" without compromising off-farm work commitments.

> *It's low maintenance. With my job - I have just enough time to do the blueberry farming.* – Grower 10

> *I wasn't looking for blueberries, I just wanted to get into agriculture. Being a small farm, blueberries are the best way to go. For workability, just maintenance...* – Grower 11

While it is clear that for these growers, the ability to balance off-farm work with on-farm lifestyle is desirable, there are significant costs that growers are contending with in order to maintain this balance, as well as systems-level implications for the industry. In order to maintain off-farm work commitments, many growers depend on professional expertise or contractors for agricultural knowledge and field-related tasks. While growers relied on a variety of channels and information sources when asking technical questions related to agriculture, the most common avenue for these questions were industry representatives and the BCBC (the council will be discussed further in section 5.3).

> *[I ask the] experts. I have a paid consultant… I have the agri-inputs field rep, I spend probably 40,000 with him so I can phone at pretty much anytime and he'd pick up. [Who does he work for?] Terralink [agricultural input company]. They are the biggest player...* – Grower 21

On the other hand, many of the smaller-scale growers do not have the economies of scale to warrant year-round paid employees or out-sourcing labour to professionals or contractors for management tasks. In some cases, this leads to self-exploitation on the part of the farm operator or their family members.

> *Well we never get fully compensated. I'm on a salary, so I work 20 hours a week [in addition to off-farm work] but I don't think I get minimum wage with the hours I put in. So I guess that's the way it is. The family members never get compensated. It's just something you have to do.* – Grower 22

> *We are not paying ourselves as of now because it's not producing enough.* – Grower 12

There was a clear sentiment from most growers who engaged in significant off-farm work (for many of them, full-time jobs), that the farming was extra, and some considered it to be a hobby, albeit it a physically and mentally demanding hobby, particularly during the summer.

5.3 Distributions of Power

There were several different power dynamics discussed by growers, and how their experiences intersected with processors, farm workers, and institutions. Because growers are heavily reliant on processors to purchase, process and distribute their fruit to retailers, the interactions between these two groups within the industry is fundamental to its structure and functioning. Growers and processors both discussed the effect of vertical integration on business

viability and decision-making power, and how these dynamics trickle down to affect growers. In terms of economic and market risk, processors are the ones purchasing and "carrying" product from growers, serving as a relatively dependable and convenient way to sell product immediately after harvest. Among participants included in this study, 22 of 31 sold some proportion of their fruit to a processor (as opposed to a retailer, distributor, or direct to consumers). Of those 22 operations, growers were selling an average of 82% of their product directly to processors, and 11 growers said they preferred this market channel due to the convenience of sales. The average proportion of the blueberry crop being sold through processors in my sample was 55% (31 growers responding). However, because larger farms were more likely to sell using this method, the amount sold to processors corresponds to 73% of the blueberry acreage in this sample[5].

However, processors also have a large amount of control over production requirements, and the power to reject fruit depending on market conditions and the season's yield. This has a few different outcomes, depending on the processor and their terms of production. One arguably positive outcome for the industry is that many processors have started to require a food safety programme certification as a requirement to any grower who wishes to sell their fruit.

> *We go through what's called a group GAP [group food safety certification]. Some processors leave it up to the individual farmer to go through the accreditation. With [our processor] every person is expected to go through the GAP process but only a handful will be audited … It becomes less onerous now that the food standard safety is there… there is a lot of onus and accountability on the farm, they give you a binder and go "look, these are the chemicals…this is your responsibility". They give you autonomy, they give you flexibility, but they also have a standard.* – Grower 29

[5]Blueberry acreage, as opposed to actual yield estimates, was used to estimate the proportion of blueberries sold to processors in this sample because the yield estimates were heavily influenced by weather and the age of plantings, and as such vary significantly year to year. The acreage in blueberries provides a more stable and accurate indication of scale of farming operations included in this study.

However, one dynamic related to the power concentration in the industry that could be potentially problematic for growers who depend on this market outlet is that processors have the power to reject fruit if it does not meet certain standards or specifications. While some processors have contractual agreements with growers, and other growers reported verbal or informal contracts with processors, some growers reported instances of processors refusing fruit during harvest seasons with particularly large yields.

> *I would always want to sell direct … process plants are very dangerous -when you sell somebody something wouldn't you want to know what they are going to pay you? The process plant doesn't tell you. They tell you they'll pay you 1/3 now, 1/3 later and 1/3 when it's sold. So nobody knows what the price is. So why would I make you a deal when I don't know what I get paid.* – Grower 27

> *For me it's a security thing, only so many packers and there are a lot of growers out there. You always hear stories of "they won't take my fruit". So it also works for packers to know how much fruit they are going to get.* – Grower 7

> *Last year… overall yield was up almost 25%, and they weren't anticipating that much, and a lot of packers didn't have room for products. At a lot of places fruit was sitting outside all night cause they had nowhere to put it. [One processor] was calling people when Duke came in the market saying "don't pick today, we won't be able to take it - we won't be able to process it". So if you don't have a contract basically and that type of situation comes up, you will be stuck with it. Nowhere to take it.* – Grower 12

While this dynamic seemed to be relatively rare among participants interviewed for this study, evidence from growers and processors alike suggests that processors are generally profiting disproportionately from this industry relative to growers. Moreover, all of the processors interviewed implied that the viability of the farm business depended largely on the processing side of their operation.

I draw my salary from the processing side. My wife works off the farm. If it was just our farm… before we set up the processing plant… both of us would have been working outside… – Grower 13

Grower: *Because there's processing we don't really know if we're satisfied from the farming side. We don't really see it that way. We see it more into a processing industry. So maybe on a farmer perspective, you know they're usually crying so how do you explain that… [laughs]. They're not happy.*
Interviewer: *So for your income including the processing business, then?*
Grower: *Then it's OK. Very satisfied.*
– Grower 17

Another un-anticipated result of this study was that farm workers were also able to exert pressure on growers due to the short supply of labour and the urgent need for growers to harvest fruit on time. Many growers expressed having a lack of control or ability to get pickers to come to their farms if they are not growing high-yielding varieties, and even accepting poor quality work standards from labourers out of fear of losing pickers to another farm

[With] pickers it's not even about wages, it's about them being able to pick 300-400 pounds a day. And if they're not happy with the amount of fruit they pick, they leave. Quick. – Grower 24

…There are not enough pickers, and so the pickers they are calling the shots… they will come and interview us. And you know Duke is a heavy producer, so they'll just strip the fruit off of Duke and some of them will pick up to 500 pounds, and if they're getting 40 cents [per pound] that's 200$. Average picking 200-250 pounds. Someone picking 500 - so they want to go to those farms that have large Duke acreage. So isn't it interesting - everybody is out there to maximize in their economies of scale. So, the grower is fearful of losing the hand pickers if they get too strict on them, so they have to turn a blind eye, but we the packers have to pay the price because the pickers are now picking a lot of green and red fruit. – Grower 13

Growers are also interacting regularly with several institutions that have a mandate to provide different types of support for the blueberry industry in the province. One of these institutions in particular, the BCBC, also offers opportunities for participation through democratic governance processes and educational field days for growers. This producer organization represented the most common form of participation among growers in my sample: 20 of 31 growers reported attending BCBC meetings, and 20 of 31 growers reported receiving resources and information from the BCBC through bulletins, events or online networks. Of those who participate in these and other socio-political processes through associations, organizations, or co-operatives, 71% felt that these processes were worthwhile, and 64% said that they felt it gave them a voice in matters relevant to their livelihoods.

While the majority of participants interviewed for this study participated in activities facilitated by the BCBC, several participants also expressed feeling excluded by this association, and some felt that the BCBC sometimes acted more in the interests of processors than growers. There was also disagreement among participants about the use of chemical sprays and the perception that the BCBC supported conventional growers over organic.

> *...They [companies and the Blueberry Council] want to make money too, and they say that you have to spray. And I say "I don't spray" and they say "you have to"...and so I feel that my voice is not listened to.* – Grower 14

However, when asked about whether they felt they had a voice in matters relevant to their livelihood through participation with the BCBC, one grower/processor, was *not* in an administrative or political role with the producer association, responded:

> *Yes. The premier returns my calls. So does the Ag Minister. It took a lot of time to develop that.* – Grower 31

While there was a sense from a few growers in this study that they did not feel well represented or supported by the BCBC, the majority of participants referred to the association as an important source of information and channel for participation in the industry. Indeed, the BCBC is one of the only avenues discussed by participants when asked about sources of support, information and opportunities for participation in the agriculture sector.

Chapter 6. Discussion

This section will provide a synthetic discussion of the results of the indicator investigation, insight from qualitative discussions, and context from the literature review outlined in Chapter 3. The dynamics herein discussed are not meant to be representative of all farms and the industry as a whole, but rather to highlight the relationship between the challenges and ideas expressed by growers interviewed for this thesis, and the variables of interest and determinants of food sovereignty identified in the conceptual framework. I will first discuss the principal findings and how they relate to equity, empowerment and ecology, and situate this discussion within the literature. I will then discuss the role of specialization in contributing to socio-ecological risk in the industry. I will conclude this chapter with a summary of the main barriers and pathways to achieving food sovereignty principles that were exemplified in this industry.

6.1 Equity

This study contributes several key insights to the understanding of equity and the socio-ecological dynamics that perpetuate inequity in agricultural systems. In particular, this includes the ways that blueberry growers are implicated in problematic labour arrangements that have been shown to lead to inequitable outcomes in the industry. This insight into the context and reasoning of producer decision-making adds nuance from this particular commodity sector to existing scholarship surrounding precarious employment and occupational health risks in BC agriculture (Weiler et al. 2016; Otero & Preibisch 2010; Otero & Preibisch 2015; Fairey et al. 2008; Preibisch & Otero 2014)

The experiences of growers has highlighted challenges with concentrated labour demands and low labour supply, the impression that they are confined to hiring workers from the few

existing pools of labour, where workers often experience socio-economic marginalization, precarious employment, and various occupational health risks (Otero & Preibisch 2015). These labour in-equities are related to barriers in accessing productive resources, as in many cases pre-existing productive in-equities (e.g. costs of land) contribute to growers being restricted in their capacity to hire outside of these labour pools. This observation is echoed by previous research about farmer behaviour and industrial agriculture, and found that farmers were more likely to resort to 'unethical' behaviour when choices were constrained by economic pressures (Hendrickson & James 2005).

Contrary to other research demonstrating that small-scale and alternative farms achieved lower or equal levels of job quality compared to larger-scale conventional farms (Harrison & Getz 2015; Weiler et al. 2016; Weiler et al. 2015), this sample illustrated a trend that smaller growers using alternative methods paid workers a higher wage, and engaged less in conventional labour arrangements with labour contractors and migrant workers. While the sample included in this study could not be deemed representative of the larger industry, the evidence presented in this thesis suggests that the labour and field management practices among mid to large conventional blueberry growers play a significant role in perpetuating labour in-equities that have been explored in occupational health literature. Despite a few examples of growers who were finding innovative and alternative ways around participating in these more problematic labour arrangements, labour hired through farm labour contractors and the SAWP were common among the farm businesses included in this sample, and were seen as the norm in the industry.

In many cases, blueberry growers themselves were also resorting to self-exploitation in order to cut costs and maintain business viability. Previous scholarship regarding self-exploitation and un-paid labour in agriculture has highlighted this as being common in organic or

agroecological farms, who often engage in more labour-intensive modes of production (Galt 2013b; Weiler et al. 2016)**.** The blueberry case offers insight into a slightly different set of circumstances that produce similar results, as growers who are engaging in off-farm work but who are resource-constrained, are subsidizing the cost of their production with their own labour. For some, this meant applying inputs and conducting other field management practices through the night while maintaining full-time employment off the farm during the day. This insight is consistent with other scholarships exploring self-exploitation in alternative food systems (Galt 2013a; Weiler et al. 2016), and is contrary to the romanticized vision of the small family farm, drawing attention to the small farm as a potential site of exploitation of the farm operator, and though not illustrated in this, the farm worker..

The costs of these in-equitable labour practices are borne by the food system and society generally in various ways. In addition to the obvious negative outcomes for individuals and their right to fair working conditions, by under-valuing agricultural labour monetarily (whether through low remuneration rates, poor provisioning of benefits, un-paid labour, or farm operators supporting their own costs of production through their off-farm work), the true cost of food is effectively depressed and/or subsidized, perpetuating pre-existing system inequities. Moreover, the way that society values (or doesn't value) agricultural jobs has societal and cultural implications. Remuneration, compensation, and the extent to which health benefits are accessible to workers are all indicators of the quality of agricultural jobs. Until a point at which standards for farm work are level with other forms of work, challenges with viable, just and sustainable farming systems will persist.

6.2 Empowerment

Growers were experiencing empowerment (and dis-empowerment) economically, politically, and socially. The most tangible way that participants demonstrated that they were dis-empowered was through resource constraints and economic pressures. Many growers expressed clear discrepancies between the ways that they would like to manage their farm business and the choices available to them, with specific reference to the economic forces limiting their decisions. Growers felt constrained in their ability to make decisions with regard to growing practices, lifestyle choices and the type of market in which they could participate. For example, many growers stated that transitioning to mechanized harvesting methods is necessary to maintain a viable business in the face of high seasonal labour demands and high costs of production relative to the price of their crop.

Off-farm work was also discussed by some growers as something they engage in by necessity to support their business, and that they would prefer to work full time on the farm. On the other hand, this disempowerment was in itself inequitably distributed, as not all growers want to work full time on the farm. Many enjoyed their off-farm work as they found it complimentary to the farming lifestyle. Others expressed being excited and proud of selling their product internationally, and preferred to engage in these markets out of this desire. These growers were empowered in this industry, albeit by dynamics that reinforce industrial and free market approaches to agriculture while excluding others.

The extent of off-farm work engaged in by farmers in our agricultural system is not only an indicator of economic dis-empowerment from constrained choices, but could also contribute to a loss of social and cultural knowledge among farming individuals, families and communities that contribute to autonomy and self-determination. The increasing trend of part-time growers

out-sourcing field expertise to consultants and agricultural input companies is one mechanism to decrease the burden and stress taken on by growers who also engage in full or part-time off-farm work. However, there are social consequences of this reduced need for in-depth understanding of the farm system on the part of growers themselves (Iles & Marsh 2012). While a recent government report found that 91% of Canadian farmers relied on their own experience when deciding whether to adopt or to innovate (Agriculture and Agri-Food Canada 2016), blueberry growers from this sample largely relied on consultants and industry specialists, many of which represented the agricultural input companies that benefit from their business. This discrepancy could be explained by the number of new growers in the blueberry industry, and by participants' levels of off-farm income in this sample.

In addition to the outsourcing of agricultural knowledge to consultants and corporations, the trend of farm operators working increasingly off the farm could also contribute to increase the dependence on seasonal labour, incentivize the transition to mechanization, and encourage the use of inputs in the place of more labour or knowledge intensive practices (Timmermann & Félix 2015; Holt-Giménez & Altieri 2012; Iles & Marsh 2012). This discussion is the counterpart to the argument put forward by Timmermann and Félix (2015) that a reconceptualization of farm work as skill and knowledge development grounded in agroecological principles would facilitate empowerment through self-determination, in addition to ecological resilience and sustainability.

Finally, the market channels though which growers were selling their berries also illustrates the coercion of economic context. The majority of growers sold most of their crop through processors, but many expressed that they would prefer to sell locally to capitalize on the high price per pound and get more direct contact with the consumer. But growers felt they were

not able to make this choice as there was no room in the local market, and the time investment required for marketing directly to consumers and retailers would be too high.

There are several insights regarding empowerment and constrained choice that can inform theoretical discussions on the tension between encouraging individual freedoms in a democratic society, and enacting the priorities identified by the food sovereignty movement (see Agarwal 2014a). In the case of market integration in particular, the BC blueberry case illustrates that despite the desire and preference to engage in local markets shown by many growers, the structural constraints acting on all growers produced a homogenous outcome whereby the majority of participants sold nearly their entire product through the same channel.

While these cases do not serve as evidence that could be considered representative of all growers, the experiences of these participants illustrates the significance of examining these constraints. Additionally, it can inform a more nuanced discussion regarding the extent to which producers around the world generally are seeking opportunities to engage with industrial and export-oriented supply chains, or whether they are simply lacking other viable options. While there were certainly some growers in BC who expressed their preference of selling through processors to international markets, many expressed that it was due to a lack of other opportunities locally. This is in contrast to recent research on blueberry supply chains in Latvia and Serbia, which found that direct and local marketing channels (such as street selling) only exist out of a lack of other market opportunities (Grivins et al. 2016).

6.3 Ecology

The assessment using indicators of ecological resilience as outlined in Chapter 4 (also see Appendix B) allowed for the concrete assessment of the processes and outcomes related to key

ecological criteria on each of the farms. Some results of this assessment are highlighted in Appendix C (e.g. low agrobiodiversity, high use of inputs, high dependence on managed honeybees). The indicator results from this sample of growers show a trend toward industrialization and a high level of similarity in growing practices, which follow certain conventions as promoted by the various institutions that provide technical support to the majority of growers. However, these indicator-based characteristics in isolation say little about the social, political and economic drivers in the system that shape (and in many cases perpetuate) the emergent ecological dynamics and structure of this system. The results reported in Chapter 4 (e.g. labour and the transition to mechanization, livelihoods and off-farm work, and power dynamics within the industry) interact to contribute to ecological outcomes at both the farm-scale, and the landscape-scale of the Lower Fraser Valley.

The industrialization of food production and associated losses in biodiversity and resilience is well-documented (Tscharntke et al. 2012; Tuck et al. 2014; Donald 2004; Chappell & LaValle 2011) and itself undermines social and ecological capacity for long-term, sustainable food production (IPES-Food 2016). The complex dynamics explored in this research highlight the way that the combination of political forces, economic constraints, and ecological realities can amplify one another, reinforcing industrial production practices (Buttel 2006), and posing challenges to achieving food sovereignty principles.

There are several significant ecological concerns facing the industry that were discussed extensively by growers, most notably: the risk of pest outbreaks, achieving adequate pollination, and adapting to climate change. Though it is not without its challenges[6], enhancing

[6] Refuges for biodiversity such as hedgerows and un-managed fields can harbour pests (such as the SWD) (Capinera 2005), and are also perceived as a loss of productive land. In-field

agrobiodiversity on the farm in order to encourage beneficial insects, provide habitat for pollination, and generally reduce vulnerability to fluctuations and disturbances, has been shown to increase resilience and adaptability in the face of these challenges. However, there are a number of structural forces at work that counter-incentivize these practices (e.g. the extremely high price of land).

Both mechanization and labour shortages in BC blueberry production are examples of socio-economic industry dynamics shaping ecological outcomes. Currently, there are few blueberry varietals that can be picked with a machine due to damage and internal bruising that decreases shelf life of berries. With the increased use of mechanized harvesting practices, there is an increasingly large proportion of blueberries destined for the frozen or processed market, contributing to market saturation that can depress blueberry prices (see Chapter 4 for results, and Yang 2010 for economic analysis of blueberry investment). In addition, there are more and more growers choosing these few varieties that lend themselves to these harvesting methods due to their size and firmness. Concurrently, several growers expressed being influenced in their varietal choices by picker preferences. Since pickers are paid a piece rate (by the pound), and labour is in high demand in the region, pickers can maximize their profit by choosing employment on those farms growing high-yielding varietals and they have begun exerting pressure on producers to grow the highest yielding varieties with larger fruit. One grower described concretely how the high yielding varieties have higher input requirements for fertilizers and irrigation, and that he was moving away from older varieties that have more natural vigour. Together with the general drive to maximize yield and profit, these forces are

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agrobiodiversity can also present challenges to mechanization. However, research suggests that long-term gains from these approaches can outweigh short-term losses in production (Kremen et al. 2012; Letourneau et al. 2011; Altieri & Nicholls 2004; Tilman et al. 2001).

contributing to decreased ecological diversity in the industry in order to maintain business viability.

This investigation into food sovereignty principles, and specifically into the ecological aspects of production systems as they interact with social dynamics, can also offer contribution to our understanding of the stratification of farms based on modes of production, or what Vandermeer and Perfecto (2012) call 'syndromes of production'. The conventional-organic binary has been employed, explored and problematized as a research tool to contrast two relatively distinct and regulated systems of production (see e.g. Reganold 2013; Seufert et al. 2012; Ponisio et al. 2014). However, the acknowledgement of the industrial nature of many organic food production systems, as well as the limitations of organic regulations in specifying production practices apart from a lack of synthetic chemical inputs has raised important questions regarding the ecological benefits and resilience of organic systems (Kremen et al. 2012).

This research involved an assessment of a wide variety of farm characteristics and management practices, including soil conservation practices, biodiversity levels, nutrient management practices, pesticide use, and pollination practices. This suite of indicators provides a more comprehensive representation of ecological dimensions of agricultural management not simply based on input substitution and third-party certification, but on defining characteristics of management schemes. Based on these indicators, a more useful distinction between growers in this sample would be between industrial and alternative growers. With the 33 growers interviewed for this sample, the organic-conventional distinction and the associated assumptions of ecological management practices with the latter would have been misleading. Three of the 11 organic growers were similar to the 'conventional' growers (i.e. non-organic and input-intensive

farms) in all but one way – their inputs were acceptable under organic regulations. On the other hand, several of the non-organic certified growers used no pesticides whatsoever (organic or conventional), and fostered more agrobiodiversity than farms that were certified organic. The approach to resource use, particularly nutrient management, was also counter-intuitive, as soil testing and targeted fertilizer applications based on nutrient needs were far more common on industrial farms than alternative ones.

The practices used by growers within this sample highlighted the ways that some producers may use sustainable practices while still operating a largely industrialized system, whereas other growers were dominantly organic or agroecological in their orientation, yet engaged in some industrial practices such as synthetic nutrient inputs and mechanized harvesting. While the organic-conventional distinction has merit for the isolation and control of factors for the sake of comparison (particularly for input substitution), a careful circumspection into the hypothesized "bifurcation" between the industrial-alternative spectrum could greatly enhance our understanding of the full spectrum of syndromes of production.

6.4 Decreased Diversity and Socio-Ecological Risk

Social, economic and political forces have played a significant role in shaping the blueberry industry in BC, resulting in complex dynamics and mixed effects surrounding equity, empowerment and ecology in the industry. In particular, the trend of substantial and concentrated growth of the industry coupled with dominantly industrial modes of production has various implications, both economically and ecologically. With one region's agricultural economy so dependent on a single crop, a large number of farmers will be subject to the same economic disturbances caused by price fluctuations. In other words, the risks will be concentrated and there

will be little buffer in the case of a disturbance (Darnhofer, Bellon, et al. 2010; Adger 2006). Particularly if this market is volatile, these changes can have ripple effects, where the impacts felt by farmers in a given industry progress to neighbouring or related industries through system interactions. One example of this in BC is the relationship between primary agricultural production and the fruit and vegetable processing sector in the province (Rice 2014). The ecological implications of this trend are of a similar nature – with less ecological diversity either at the level of the farm field or the agricultural landscape, there is a reduction in the capacity of that agroecosystem to generate and re-generate ecosystem services such as pollination, water use efficiency and soil fertility (Kremen et al. 2012).

In ecological resilience theory, a reduction in functional biodiversity can lead to disastrous consequences. When the diversity of responses to environmental change among species that contribute to the same function is reduced, the resilience of that system to change or disturbance is also reduced (Folke et al. 2004). This relationship between diversity and resilience, referred to as response diversity, is also relevant to social systems, where heterogeneity in human decisions and actions at multiple organizational scales can lead to a diversity of responses to challenges, opportunities and risks, increasing the resilience of socio-ecological systems (Leslie & McCabe 2013). In this way, increased homogeneity of the agricultural landscape could have ecological, economic and social implications for resilience of BC's agricultural system, particularly in the face of impending climate change.

Figure 7 illustrates the dynamics surrounding labour inequities, economic dis-empowerment and accumulated socio-ecological risk.

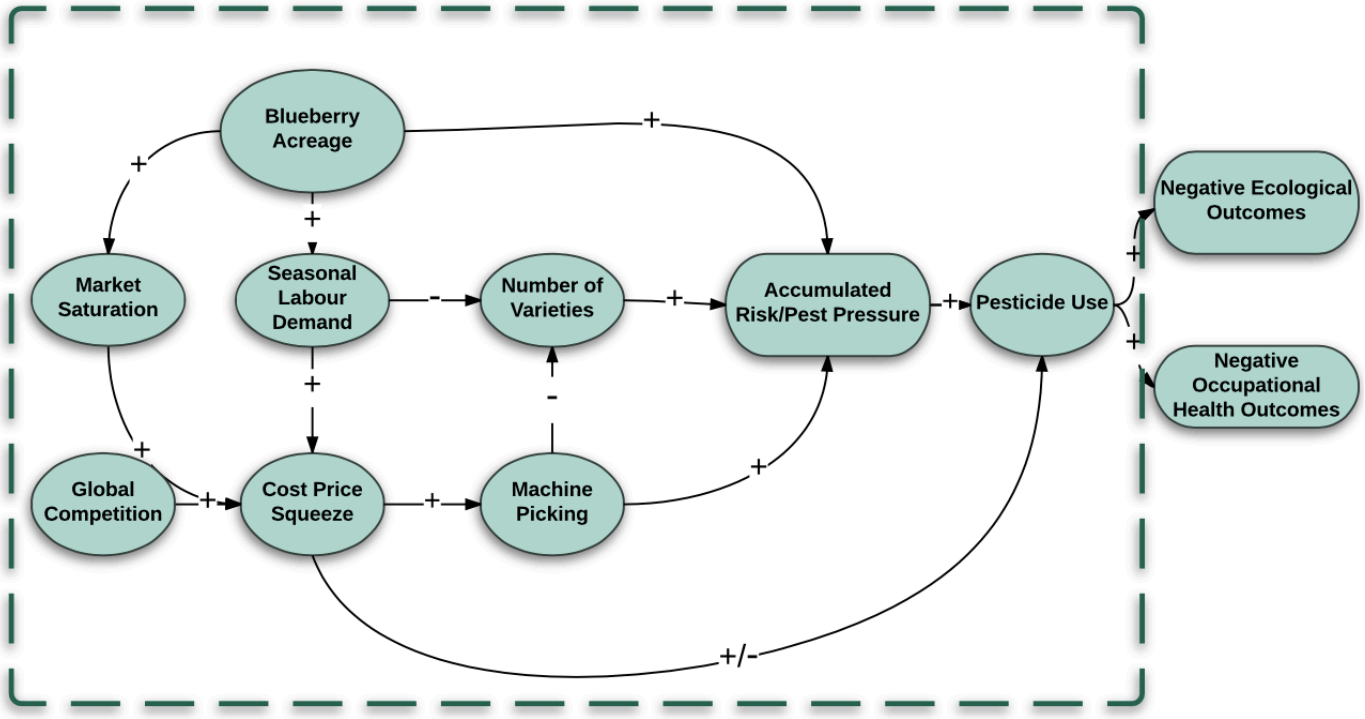

Figure 7. Dynamics and Interactions Between Labour, Mechanization, Blueberry Varietal Diversity and Socio-ecological Outcomes
Dotted line indicates the system boundary of this study as focusing on growers as the stakeholder of interest. In the blueberry industry the high costs of productive inputs, declining price and challenges finding markets are placing high demands on seasonal labour, contributing to the shift towards fewer varieties and increased mechanization, consistent with the industrial production model. This, in turn, is exacerbating existing challenges to ecological resilience such as increased pest pressure (accumulated risk in the form of monocultures and homogenous landscape, creating ideal feeding grounds and habitat for pests like SWD), necessitating increased pesticide use with associated negative outcomes for workers and the environment.

6.5 Barriers to Achieving Food Sovereignty Principles

As producers of a high-value commodity crop, blueberry growers may not be considered by many to be a 'marginalized' group of farmers. Yet, this assessment of food sovereignty principles has revealed that there are several factors in effect that are limiting their capacity for self-determination and decision-making autonomy, influencing their management practices and affecting the ways that they participate in local and global markets. Based on the evidence collected here, the most significant barrier to achieving food sovereignty principles in the

industry is the combination of economic forces and social dynamics that have most growers locked into an industrial production cycle. In terms of business viability, growers have little to no actual choice with regards to many of their management practices but to produce cheaply, adopt conventional technologies to do so, and draw from what resources and labour pools are available to them (Weiler et al. 2015; Skogstad 2007; Barnetson 2009). The 'cost-price squeeze' is ubiquitous in critical food system scholarship that recognizes the coercive nature of context, and describes the self-reinforcing feedbacks of industrialized production and trade liberalization that restrict and inhibit farmers' capacity to shift practices, let alone to radically rethink or reorient their approach to agriculture altogether (IPES-Food 2016; Iles & Marsh 2012; Galt 2013b). The implications of this go beyond affecting farmer empowerment through reduced autonomy and constrained choice, but also contribute to inequities experienced by farm workers due to the reliance on low-wage and marginalized workforce, which keeps farm costs down and supports business viability (Weiler et al. 2015; Weiler et al. 2016). Moreover, these complex interacting socio-economic dynamics are interacting with ecological systems, creating concentrated risk due to low agrobiodiversity and high input dependence, amplifying vulnerability to existing problems such as climate change, pest threats and pollination challenges.

The changes in the BC blueberry industry, including rapid growth, increased market integration, and industrialized production models, are suggestive of transition to commodification. While this has historically been a high-value horticultural crop, with smaller scale production and more often directly-marketed, evidence from growers reflects a shift to a global commodity with low margins, which is driving the industrialization of production. Participation in this global marketplace requires higher standards for production (e.g. food safety

programmes), and value added production through vertically integrated operations (Thompson & Scoones 2009), which are consistent with evidence from the blueberry case.

6.6 Processes Supporting Food Sovereignty Principles

Institutions "make societal interaction predictable and guide human action towards collective goals", and as such, can be key entry or "leverage points" for socio-ecological systems change (Abson et al. 2016, p. 5). As discussed in Chapters 3 and 4, the BCBC and the BC Ministry of Agriculture are important institutions for the industry that both support and empower growers through democratic participation opportunities (predominantly the former), knowledge translation, and field expertise (predominantly the latter). Evidence from interviews with growers suggests that they view the BCBC as an effective network for support, participation and empowerment for many. However, some growers also highlighted how they felt this institution represented the interests of only some growers and processors, and perpetuated conventions and dominant approaches seen in the industry. Grower interviews and participant observation suggest that the BCBC is providing significant support for and facilitation of some sustainable management practices such as IPM, targeted nutrient management, and efficient irrigation systems. Notwithstanding, the over-arching model of agriculture espoused by the council is still largely reflective of input-intensive systems with low biodiversity, which is at odds with the principles of ecological health and resilience promoted by the food sovereignty framework. Potentially as a result of this, most 'alternative' growers did not identify the BCBC as a significant source of information or support for their growing practices, and were utilizing their organic producer associations to access information and support regarding their management practices.

While the BCBC may not be serving as a major leverage point for agricultural systems transformation to achieve agroecological principles, as a prominent institution that connects, enables, and empowers growers in the blueberry industry, it is evidently an indispensable support system. Thus, the BCBC can be considered to be facilitating processes for achieving food sovereignty principles of empowerment.

Another institutional mechanism that has the potential to facilitate food sovereignty principles is third-party certification, as it can incentivize, promote and ensure standards of growing practices that can lead to beneficial outcomes for human and ecological health. While organic certification is perhaps the best-known third-party certification to the public, the most common certification pursued by growers in the blueberry industry is Good Agricultural Practices (GAP), a food safety program that certifies processes in fruit and vegetable production, packing and storage (CanadaGAP 2016). GAP certification is increasingly common in blueberry production in the region, and many processors require producers to become certified in order for them to sell their berries (Lev 2015). 18 of 33 growers in this study had farms certified under GAP or a similar food safety program certification, and discussed changes to chemical storage facilities, and occupational health protocols as a result of the GAP program standards. According to growers and processors alike, these certifications have become a necessary prerequisite to sell in the export market, as Canadian berries have to compete with other high quality producers from South American and the United States.

However, the third-party certification scheme may also present challenges to food sovereignty processes and principles. Many growers (particularly small operations) discussed the challenges with required investments of time and money associated with documentation and implementing the necessary procedures. Despite group certification schemes reducing costs and

barriers for growers, the relative burden of implementing some GAP procedures is particularly significant for small-scale growers, and the top-down nature of the certification requirements highlight the concentrated power that processors have in the industry.

Notwithstanding these challenges to equity and empowerment, the food safety certification requirements, which are largely motivated by participation in the export market, seem to be having positive outcomes on the farm for worker and consumer safety, as well as ecological health.

Chapter 7. Conclusion

7.1 Strengths and Limitations

As an in-depth case study, this research has empirically evaluated dynamics as experienced by a particular stakeholder group of interest (growers) related to a distinct industry. The conceptual framework and methodology grounded in food sovereignty theory and socio-ecological systems literature facilitated a unique combination of systems-level breadth and case-specific depth. In addition to the concrete empirical assessment of a wide array of variables, this analysis contributed and a nuanced understanding of complex social processes that are influenced by, and contribute to the state of equity, empowerment and ecology in the industry. Moreover, this evaluation has taken explicit consideration of larger scale dynamics, such as market demands and global competition, and has situated the BC Blueberry industry and its growers within this larger 'landscape' of institutional and economic forces. As an industry that is experiencing similar challenges, opportunities and transitions to many other agricultural commodity sectors, there are a great number of lessons that can be learned from this examination that are generalizable to a broader context. In particular, the implications of commodification and industrialization of agriculture, and how these trends interact with economic constraints to re-enforce certain trends in labour equity, political and economic empowerment, and ecological resilience, have significant implications for agricultural policy at multiple levels, and hold significant potential for future research.

Though certain insights are generalizable both within and outside of the industry, there were data limitations with this study in terms of the representativeness and sampling strategy. While the approach taken here enabled a targeted and purposive sample to represent diversity within the industry, a larger, randomized sample would have allowed for broader conclusions to

be made regarding industry-wide trends. In addition, the study's in-depth focus on a single stakeholder group did not allow for a more comprehensive picture of the ways that the dynamics explored in this thesis interact with farm workers and farm family members (particularly women, as they were under-represented among interviewed farm operators). While this thesis leveraged evidence from existing literature in order to shed light on the experiences of farm workers, gender dynamics and inequities as they relate to the blueberry industry remained largely unexplored in this research. Finally, while the focus on decision-making autonomy, constraints and motivations of growers allowed for conclusions regarding larger socio-political dynamics shaping these processes and outcomes, there was little to no evaluation of the outcomes *themselves*. In larger project with additional time and resources, empirical measurements of carefully selected outcome indicators (e.g. soil properties) would have provided complementary data to what has been presented in this thesis.

7.2 Future Directions

Change in response to this multitude of stressors is both inevitable and necessary (Liu, Dietz, Carpenter, Folke, et al. 2007; Adger et al. 2005). With this in consideration, enhancing the adaptive capacity of the sector and its sub-systems by improving equity, empowerment and ecology should be an important priority. Consistent with the attention to multi-scalar dynamics taken in this research, there are several potential entry points for intervention for both research and policy between the farm unit (encompassing of many different actors including farm workers and the farm family unit), the regional landscape (with its own complex socio-ecological dynamics), the supply chain intermediaries, and the provincial and national legislative frameworks the influence socio-ecological dynamics at every scale.

In terms of production at the farm and landscape scale, there are several strategies that have been identified that can enhance the socio-ecological resilience of agricultural systems which are broadly geared towards diversification, whether this be agricultural products, income streams, marketing approaches, or of genetic and landscape composition in the agro-ecosystem (Kremen et al. 2012; Engle 2011; Darnhofer, Bellon, et al. 2010; Crawford & MacNair 2012). However, diversification may present some level risk in and of itself, and the long-term pay offs of increased resilience may not outweigh the short-term risk of transitioning to a new business model, market, or crop, particularly for farm operators that may be near retirement (Crawford & MacNair 2012). Furthermore, younger farmers may not possess the financial capacity or experience to make such a shift. In the case of blueberries, farmers are perhaps less likely to take maturing blueberry bushes out of production in order to diversify their farm; however, diversifying their business model through value-added products present a potential way of weathering changing conditions.

At the level of regional, provincial or even national policy, there are several pathways that hold potential for the institutionalization of food sovereignty principles and priorities. These could include ways of empowering small and more marginalized producers within larger sectors, and enhancing existing pathways to support innovative and alternative practices. This could involve mechanisms for knowledge sharing between sector associations and groups, and seeking democratic representation of the full spectrum of interests and growing practices. The direction of breeding efforts should also take into consideration ecological resilience and targeting long-term gains over and above short-term yield. Governments should also seek to incentivize varietal and agrobiodiversity.

It will also be important to problematize current labour arrangements in terms of their long-term impacts on the industry through system level feedbacks, as well as the system-level impacts of the increased adoption industrialized practices such as mechanization. Recent research has called for changes to address dangerous and unhealthy labour arrangements in BC and in Canada. Many of these studies have included clear and concrete recommendations to improve inequitable and unfair working conditions present in agricultural jobs, such as removing barriers to healthcare access for migrant workers, abolishing the minimum piece rate, and eliminating farm labour contracting system (Weiler et al. 2015; Hennebry 2012).

Even with these efforts, significant re-orientation of food systems governance and policy combined with other economic re-structuring and social empowerment mechanisms would be needed to approach the realization of food sovereignty principles in the BC food system.

7.3 Final Remarks

This case study has highlighted some ways in which global agricultural markets and industrialized agricultural production have created conditions that erode the adaptive capacity of a system in the long-term; yet, international trade is also being pursued as a solution to the challenge of selling a crop to an already saturated market (Government of Canada & BC Ministry of Agriculture 2010; Agriculture and Agri-Food Canada 2014). While industry organizations such as the BC Blueberry Council can provide substantial support to producers in the form of information and access to services and resources (Crawford & MacNair 2012), they are also implicitly involved in perpetuating cycles of inequitable labour outcomes and industrialized production practices, and have the potential to undermine adaptive capacity if recommendations and support are not beneficial for producers in the long term (Birkenholtz

2012). In addition, support programs administered by networks and organizations with the goal of building adaptive capacity must balance effective compensation for losses and financial support with efforts to bolster industry self-sufficiency (Crawford & MacNair 2012).

This research contributes a novel approach to emphasize hierarchical coupling and nested vulnerabilities that are connected through globalization at multiple scales (Liu, Dietz, Carpenter, Folke, et al. 2007; Adger et al. 2009). As mechanisms such as global trade enhance connections of geographically distant places, it will become increasingly important to understand the driving forces behind change and their associated outcomes. This case illustrates how the blueberry industry and the BC agricultural sector is nested within the global trade system, highlighting the impacts that these global connections can have at a local scale, and how these can act alongside local risks and pressures to affect equity, empowerment and ecology. The implications of this enhanced interconnectedness for government decision-making and international governance activities is significant, and should inform debates surrounding policy and financial regulation (and de-regulation) at all levels. The degree to which such complexities are taken into account will determine not only policy success, but also agriculture's future.

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Appendices

Appendix A: Interview Instrument

1. Consent

A. PRODUCTION CHARACTERISTICS

2. Farm Characteristics

1. What is your role on the farm?
2. What is the total acreage of your property?
3. What is the total acreage in production?
4. What is the acreage devoted to blueberries?
5. Do you (and your family) live on the farm?
6. Are you certified by any third-party certification body (e.g. Good Agricultural Practices (GAP), organic)? (Y/N)
7. If so, which certification body?
8. What is the annual cost of certification?

3. Production History

1. What was the first year of your farm's operation?
2. What year did you first plant blueberries?
3. How has your acreage in blueberries changed since then?
    a. It has increased substantially
    b. It has increased moderately
    c. It has not changed
    d. It has decreased
4. How much has your acreage changed by since then?
5. Did you make a business plan before planting?
6. Prior to this farm operation, did you have any experience in agriculture?

4. Blueberry production

1. What motivated you to plant blueberries?
    a. High price/good value
    b. High demand
    c. Long-term investment, perennial nature
    d. Suitability of land
    e. Prior knowledge/experience with crop
    f. Other: _____
2. Which varieties of high bush blueberries do you grow (select all that apply)?
    a. Duke
    b. Reka
    c. Bluecrop
    d. Elliot
    e. Liberty
    f. Draper
    g. Aurora
    h. Spartan
    i. Rancocas
    j. Hardyblue
    k. Northland
    l. Brigitta
    m. Other:_____
3. What was your
    a. Yield per acre of blueberries last season (2015) (per variety selected above)?

    OR
    b. Total yield of blueberries for 2015

AND

c. Total yield of blueberries for 2015

AND

d. Total yield of other crops produced and sold commercially for those years, if applicable

4. How did this yield compare to what you would consider an 'average' year:

    a. This was comparable to an average year

    b. This was less than an average year

    c. This yield was higher than an average year

5. Why do you think it was higher/lower than average?

5. Income from Agriculture

1. Do you or other members of the household/farm unit engage in paid non-farm work?
2. Do you receive income from off-farm sources, including pensions?
3. Is this/was this by choice or by necessity?

    a) Choice

    b) Necessity

4. If individuals engage in paid non-farm work, what is the motivation for this (choose the answer that best applies):

    a) Supplement income from the farm

    b) More diverse sources of year-round income

    c) Enjoyment of doing other types of work

    d) Other:_____

5. Approximately what proportion of the household/farm unit income is derived from agriculture versus paid non-farm work?
6. How much of this is income is derived from blueberry production, more specifically?
7. Are you happy with your level of household income from agricultural activities?

    a) Very satisfied

    b) Satisfied

c) Somewhat satisfied

d) Unsatisfied

e) Extremely unsatisfied

8. The rough breakdown of your costs in % for each category for 2014
   a) Labour
   b) Bees
   c) Infrastructure
   d) Inputs
   e) Other

OR

8. What are your farm's two biggest expenses?

6. Crop Diversity

1. How many other different crop species do you grow throughout a given year?

2. Please list all crops being grown in the current growing season (2015) and acreage allocated to each:

Crop	Area (rough)	Sold?
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		

7. Decision-making

1. What are the main factors that influence decisions about the farm (e.g. what to grow, management practices, etc.)

   a. Price

b. Market accessibility

c. Demand

d. Labour availability

e. Capital investment costs

f. Crop rotation

g. Soil health

h. Other: _____

8. Waste

1. What percentage of your total blueberry production is lost each year post-harvest? (Where loss refers to any blueberries produced and harvested that do not enter the supply chain)

2. What is the main reason for waste?

    a. No buyer

    b. Storage loss (spoilage)

    c. Other: _____

B. ACCESS TO RESOURCES

9. Land Access

1. Please indicate all land tenure arrangements that apply to your farm, and the proportion of land under each arrangement:

Land Tenure Arrangement	Y/N (1; 0)	Proportion of land
Owned		
Leased		
Shared/cooperatively owned		
Other:_____		

2. Regarding land owned:

    a. What year did you purchase it in?

    b. What benefits do you perceive from owning this land as opposed to leasing or sharing it? What challenges?

3. Regarding land leased:
    a. What is the cost/acre?
    b. When did you begin the lease agreement?
    c. What are the terms of the lease agreement?

    d. What benefits do you perceive from leasing this land as opposed to owning or sharing it? What challenges?

4. Regarding other types of arrangements or agreements:
    a. Please describe:_____
    b. What benefits do you perceive from this arrangement? What challenges?
5. Have you had any challenges accessing land? (Y/N)
6. If yes, please discuss these.
7. Do you wish to expand your production onto additional land?
8. If so, what are your plans for expansion?
9. If you have children, do they plan on taking over your farm?
10. Do they want to be involved in farming?

10. Socio-political and support networks

1. When you have technical questions related to agriculture, who do you ask?
2. A) Are you an active member of any of the following, where active refers to attending meetings or participating in governance processes regularly (check all that apply):
    a. Co-operative
    b. Union
    c. Association
    d. BC Blueberry Council

e. Other:_____

B) How many meetings have you attended for each option checked in the previous question?
C) Name of association/organization/institution meeting

3. For those who participate:

    a. Do you find these processes worthwhile?

        a. Yes

        b. Somewhat

        c. Not really

        d. No

    b. Do you feel you have a voice in matters relevant to your livelihood through these processes?

        a. Yes

        b. Somewhat

        c. Not really

        d. No

4. For those who DON'T participate, why not? *(Don't read options)*

    a. Not aware of any such processes, networks or groups

    b. Not interested (could but choose not to)

    c. No time (would like to but can't)

    d. Other, please specify… _____

11. Financial Supports

1. Do you receive any form of support from: the federal government, the BC Ministry of Agriculture, a cooperative, any associations, the BC Blueberry Council, informal discussions with farmers, or other institutions? If so, what kind (see table)?

Institution	Y/N	Type of support				Other Details
		Grant	Credit	Infrastructure or tools	Guidance, training or	

					information	
Federal Government						
BC Ministry of Agriculture						
Cooperative						
Association						
BC Blueberry Council						
Informal discussion with other farmers						
Other:_____						

12. Supply Chain

1. Do you know what proportion of your blueberries are sold through each?

Market Type	**Proportion of Production (%)**
Internationally, through distributor	
Locally, direct to consumer	
Locally, direct to retailer	
Locally, through distributor	
Wholesaler	
Directly to packer/processor	
Other:_____	

2. How would you prefer to sell your crop? Why? *(Don't read options)*
    a. Locally, directly to consumers, off-farm (e.g. farmers' market)
    b. Locally, direct to consumer, on-farm
    c. Locally, directly to retailer
    d. Locally, through distributor
    e. For export, through distributor
    f. Other: _____
3. Proportion of fruit sold fresh?
4. Proportion of fruit sold frozen/processed?
5. Do you have any u-pick operations or value-added products or activities as a part of your farm business such processing facilities?
    a. U-pick

b. Processing

c. Other:_____

6. Is there a formal traceability scheme to trace products back to the place of origin to deal with possible food safety issues? (Y/N)

13. Buyer Contracts & Market Stability

1. Do you have a contract with a buyer or distributor for your blueberries? (Y/N)
2. If so, what is the duration of this contract?
    a. Year to year (no longer than one year)
    b. Multiple years (2-5)
    c. Long-term (5+ years)
3. Are there any other conditions of this contract?
4. What do you perceive are the impacts of this type of contract:
    a. On your autonomy and ability to make decisions (-3 – 0 – +3)
    b. On your financial security (-3 – 0 – +3)

C. AGRICULTURAL PRACTICES

14. Pest Management

1. What types of pest management strategies do you use? Select all that apply.
    a. Organic
    b. IPM
    c. Conventional
    d. Other, please specify: _____
2. Please describe your IPM regime (Hire ES Crop Consult? Other details/practices?)

3. Do you apply any **synthetic** pesticides (pesticides that are not organic/biological controls)? (Y/N)

4. How would you characterize your application of these (**synthetic** pesticides):
    a. Frequent and liberal application
    b. Somewhat frequent application following guidelines/instructions
    c. As needed or sparingly in minimal concentrations
    d. Only as a last resort

5. Do you apply any **organic** pesticides or biological treatments? (Y/N)

6. How would you characterize your application of these (**organic** pesticides):
    a. Frequent and liberal application
    b. Somewhat frequent application following guidelines/instructions
    c. As needed or sparingly in minimal concentrations
    d. Only as a last resort

7. Please list the types of organic treatments applied on a regular basis, what company these are purchased from (Table 2).

8. Do you use any other equipment to deter larger pests or animals (such as nets or cannons)?

    a. Nets

    b. Cannons

    c. Other, please specify:_____

15. Nutrient Management

1. What is your nutrient management regime? Please make reference to specific practices and inputs used (FOR ALL CROPS):

    a. Use of farm compost and mulches

    b. Use of animal manure

    c. Incorporation of N-fixing plants

    d. Synthetic fertilizer inputs

    e. Other, please specify…

16. Soil Fertility

1. Do you engage in any of the following practices to enhance soil fertility and/or restoration, and if so, how often?

Practice	Extent				Comments	Blueberries	Other crops
	Regularly (at least every year)	Some of the time (every few years)	Not usually	N/A			
Compost green waste							
Application of sawdust mulch							
Crop rotation							
Inter-cropping							
Green manures/ plough-ins							
Leave green waste/grass clippings							
Other? (please specify)							

17. Water Usage & Quality

1. Does your farm have either windbreaks/shelterbelts or buffer zones in order to decrease soil erosion and nutrient runoff? If so, did you install these yourself, or were they inherited features of the farm when purchased? Any other physical features that would decrease erosion?

	(Y/N)	Self-installed	Inherited	Comments
Windbreaks or shelterbelts				
Buffer zone or strip				

Other (please specify):				

2. What irrigation methods do you use? If multiple, what proportion of your blueberries are irrigated in each?
    a. Drip
    b. Overhead
    c. Other:_____

18. Pollination

We are interested in knowing any characteristics of your farm or approaches you use to enhance pollination on your farm and/or support pollinator populations. Do you (please check all that apply):

1. Have managed beehives on your property? How many?
2. What kind?
3. Bring in managed bee colonies? How many?
4. What kind?
5. Do you have any semi-natural areas or non-crop plantings on your property?
    a. If so, what kind:
        a. Unmanaged pasture
            i. How much?
        b. Woodlot
            i. How much?
        c. Riparian buffers
            i. How many?
        d. Hedgerows
            i. How many?
        e. Wild flowering plants growing in field borders
    b. Other techniques:_____
6. Do you feel that your crop receives adequate pollination?

7. Why or why not?
8. Do you observe any native or wild pollinators in your fields?
9. Do you have any plans for strategies to enhance pollination?

Other

10. Do you have any other agriculture-related activities on your farm that have not been discussed, such as a subsistence garden, chickens, or livestock?

D. LABOUR

19. Employees

1. How many of each class of workers did you hire this past season (2015)?

Type of work	**Number of workers**
Full time (year-round)	
Part-time (year-round)	
Seasonal (full-time)	
Seasonal (part-time)	
SAWP	

2. List all positions on the farm (including yourself, all farm workers, operators, and owners), the age and gender of each individual, and the amount of paid non-farm work engaged in by individuals:
    a. 16-24
    b. 25-34
    c. 35-49
    d. 50-69
    e. 70+

Position	Age bracket	Gender	Race	Owner? (Y/N)	Family member? (Y/N)	<20 hours/week	>20 hours/week

20. Remuneration

1. What is the average/standard wage paid to workers on your farm?
2. If piecework, what is the price paid per pound?
3. Are there any informal labour arrangements on the farm (e.g. volunteering, apprenticeships, or family labour agreements)?

B. OCCUPATIONAL HEALTH

21. Personal health and perceptions of others' health

1. In general, how would you rate your physical health?
    a. Poor
    b. Fair
    c. Good
    d. Very good
    e. Excellent
2. In general, how would you rate your emotional health (e.g. stress levels)?
    a. Poor
    b. Fair
    c. Good
    d. Very good
    e. Excellent

3. In the past 5 years, have you had any injuries that you believe may be related to working conditions, work exposures or work tasks that required medical attention, or prevented you from performing your regular activities for half a day or longer? (Y/N)
4. If yes, please describe.
5. In the past year, have you had pain, discomfort or other symptoms (such as skin or eye irritation) that you believe may be related to working conditions, work exposures or work tasks?
6. How long did you work with these symptoms?
7. How many days were you NOT able to work because of these symptoms?

22. Work Experiences

1. How satisfied are you with your job and its working conditions?
    a. Satisfied,
    b. Fairly satisfied,
    c. Fairly dissatisfied
    d. Dissatisfied
2. How often do you personally apply agro-chemicals?
    a. Frequently, several times per month
    b. Sometimes, several times per year
    c. Rarely, not more than once per year
    d. Never, I do not apply agro-chemicals personally
3. Are you exposed to *other people's* use of agricultural chemicals?
    a. Frequently, several times per month
    b. Sometimes, several times per year
    c. Rarely, not more than once per year
    d. Never, I am never in the field when others are applying agro-chemicals
4. Do you have/provide access to Personal Protection Equipment?

5. Have you received PPE training? (Y/N)
6. Have your employees received PPE training? (Y/N)
7. What did this training entail? Please describe briefly.
8. If you do have/provide access to PPE, how often do you use it when applying agricultural chemicals?
    a. Always
    b. Sometimes
    c. Never
9. When you use PPE, how protected do you feel? Please rate the level to which you feel you are protected from 1 to 7, where 1 is the least protected and 7 is most protected.
10. How often are you directly exposed to agricultural chemicals without Personal Protective Equipment?
    a. Never directly exposed
    b. Rarely directly exposed
    c. Several times per year
    d. More than 5 times a year
11. How concerned are you concerned about this level of exposure? Please rate your level of concern from 1 to 7, where 1 is not at all concerned, and 7 is extremely concerned.
12. Which of the following statement best applies:
    a. My employees do not use agricultural chemicals
    b. My employees use agricultural chemicals, but always use appropriate protection
    c. My employees are always offered appropriate protection but sometimes don't use it
    d. My employees always have access to Personal Protective Equipment but most don't use it

e. My employees use agricultural chemicals but not at a level that requires them to wear any special protective equipment

13. How concerned are you about the level of exposure of your employees? Please rate your level of concern from 1 to 7, where 1 is not at all concerned, and 7 is extremely concerned.

14. Have you ever had to seek medical attention as a result of acute exposure to agricultural chemicals?

15. Have your employees ever had to seek medical attention as a result of acute exposure to agricultural chemicals?

16. Have there been any work related injuries or episodes of illness reported on your farm in the last 5 years?

17. If so, how many?

23. Workplace Setting

1. Are there workplace safety regulations that are posted and visible on the farm?

2. Do you have any on-farm spaces for relaxation and/or recreation?

24. Healthcare Access

1. What do you see as some of the major barriers to healthcare for your workers, particularly for employees from the Seasonal Agricultural Worker Program?

2. (If growers employ temporary foreign workers) Do you switch your employees from private to public insurance following the interim 3-month period?

3. Can you remember a specific time when you incorporated employees' feedback about health and safety in your workplace? If yes, please describe briefly.

Appendix B: Full Table of Food Sovereignty Indicators

Category	Variable	Criteria	Indicator	Analysis	Quant Type	Process	Outcome
Production Practices	Pest Management	Minimize negative impacts of pesticide-use	IPM	Quant	Binary	X	
			Synthetic pesticide use	Quant	Binary	X	
			Organic pesticide use	Quant	Binary	X	
			No spray	Quant	Binary	X	
			Description of Synthetic pest application strategies	Quant	Categorical		
			Toxicity of pesticides used	Qual		X	
	Nutrient management	Achieve soil fertility in a sustainable way	Soil test	Quant	Binary	X	
			Recycling practices	Quant	Binary	X	
			Innovative practices	Qual		X	
			Targeted fertilizer applications	Qual		X	
	Soil and water conservation	Conserve soil and water resources	Irrigation (overhead, drip, none)	Quant	Categorical	X	
			Presence of windbreaks/shelterbelts	Quant	Binary	X	
			Mulching	Quant	Binary		
	Yield	Optimize yield	Blueberry yield (lbs) per acre	Quant	Continuous		X
Agro biodiversity	Pollination	Sustainable, resilient and effective crop pollination	Rent hives	Quant	Binary	X	
			Hives per acre	Quant	Count	X	
			Presence of pollinator habitat	Quant	Binary	X	
			Observed wild pollinators	Quant	Binary	X	
			Adequate pollination	Quant	Binary		X
			Pollination plans	Qual		X	
	Cultivated	Enhanced ecological functioning (natural pest suppression, pollination)	Number of varieties	Quant	Count	X	
			Number of cultivated crop species	Quant	Count	X	
	Non-cultivated	Plant biodiversity for habitat for beneficial insects	Extent of un-managed land	Quant	Continuous	X	
Institutions and Networks	Participation in socio-political networks	Empower food system actors	Number of meetings attended	Quant	Count		
			Perceived value of participation	Quant	Categorical		X
			Perceived empowerment of participation	Quant	Categorical		X
	Access to information		Channels through which information is accessed	Qual		X	

Category	Variable	Criteria	Indicator	Analysis	Quant Type	Process	Outcome
	Institutional Support		Institutions providing support	Qual		X	
			Type and quality of support	Qual			X
	Third-party Certification	Incentivize good agricultural practices	Farm certification	Quant	Binary	X	
			Type of certification	Qual		X	
Labour Practices	Occupational health	Fair and healthy working conditions	Access to PPE for workers	Quant	Binary	X	
			Training for PPE use for workers	Qual		X	
			Safety regulations posted and visible on farms	Quant	Binary	X	
			Access to lunchroom and recreation spaces	Quant	Binary	X	
			Reported incidents/accidents (workers)	Quant	Count		X
			Personal injuries/pain/disomfort (growers)	Quant	Count		X
	Fair labour practices		Standards wage paid to workers	Quant	Continuous	X	
			Dependence on unpaid labour	Qual		X	
Business Model & Supply Chain	Market integration	N/A	Proportion of direct sales	Quant			
			Proportion of sales to processor	Quant			
			Preferred market type	Qual			
	Supply chain	Security of market for product sales	Vertical integration	Quant	Binary		
			Contractual agreement	Quant	Binary	X	
			Benefits/Challenges of contract	Qual			
	Viability	N/A	Distribution of costs	Qual			
		Minimize losses and waste	Waste & loss	Quant	Percentage		X
		N/A	Mechanization	Qual			
Livelihoods	Income	Viability of farming as a livelihood and income source	Proportion of income from agriculture	Quant	Percentage	X	
			Off-farm income	Quant	Binary	X	
		Satisfaction with income from agriculture	Self-reported satisfaction with income from agriculture	Quant	Categorical		X
			Reason for off-farm work	Qual		X	
	Land tenure arrangement	Security of land tenure and autonomy over farming operation	Proportion of land owned vs leased	Quant	Percentage	X	
			Benefits/Challenges of land owned	Qual			X
	Values and motivations	N/A		Qual			

Appendix C: Selected Results of Food Sovereignty Indicator Assessment

Category	Indicator	Description of variable measured	Results	Conclusions
Production Characteristics	Synthetic Pesticide Use	Whether growers used synthetic pesticides, and the application approach used	• 21/33 use synthetic pesticides • Of those, 9 use synthetic pesticides "Somewhat frequent following instructions", and 12 use them "as needed or sparingly and in minimal concentrations" • No growers reported synthetic pesticide application rates in the lowest or highest category • 7/33 growers used no pesticide inputs whatsoever	Most growers interviewed used synthetic pesticides, and the products being applied and rates of application were consistent in my sample. However, several growers are 'no-spray', and these were not limited to organic growers.
	IPM approaches	Whether or not growers reported using Integrated Pest Management (IPM) Practices	• 19/31 use IPM techniques • This included those out-sourcing field monitoring and other tasks to consultants	Many growers are using integrated and preventative methods to control pests. Some growers were not familiar with the term IPM, but identified IPM practices as a part of their pest management regime.
	Soil testing	Whether or not growers would test their soil to identify nutrient and micro-nutrient deficiencies/surpluses	• 23/31 conducted soil tests to determine nutrient input needs	Soil testing was an important part of most growers' nutrient management regimes. Those who were *not* soil testing were disproportionately organic growers.
	Blueberry yield	The reported number of pounds of blueberries produced by acre of berries in production	• Yield per acre varied between 120 and 16,851 pounds • The 12 farms with the highest yield were all conventional, with yields of at least between 8,000 pounds per acre	Reported yields varied dramatically. Conventional farms were the highest yielding, but some organic farms also performed well. Farm size did not seem to affect yield per acre.
	Rent hives	Whether or not growers rely on managed honeybee colonies rented from apiarists	• 25/32 use managed honeybees for pollination • 22/32 hire apiarists to bring in honeybee hives • 4/32 keep bees on their property • Most use between 3-5 hives per acre, according to recommended practices • 7/32 growers do nothing, and/or rely exclusively on natural pollination	The majority of growers use managed honeybees for pollination, and there is little variation in the number of hives used per acre. Some are relying on natural pollinators.
Agro biodiversity	Wild pollinators	The presence and extent of habitat for pollinators on the farm property, and whether growers observed wild pollinators in field	• 9/31 reported having habitat for pollinators on the property in the form of un-managed land, which ranged from 0.14 to 7 acres • 28/31 growers have observed wild pollinators in their fields • 4/31 growers reported planting flowering crops specifically to attract pollinators	While most growers do not have land allocated to habitat or un-managed area, there are a select few that have specifically planted flowering plants for pollinators. Despite this, nearly all growers observe wild pollinators in their fields.

Category	Indicator	Description of variable measured	Results	Conclusions
	Number of blueberry varieties	The number of varieties of blueberries cultivated	• The number of blueberry varieties varied between 1 and 16 • The average number of varieties on a farm was 3.7 • 15/33 had 2 varieties or fewer	Most farms grew more than one variety, but there are still a large number of growers depending on few varietals.
	Number of cultivated crop species	The total number of crop species cultivated on the farm	• Crop diversity ranged between 1 and 10 • The average crop diversity was 1.88 • 22/33 grew only blueberries (crop diversity of 1) • Only 3 farms had a crop diversity higher than 4	Most growers are only growing blueberries, apart from a few farms. There is no relationship between crop diversity and farm size in this sample.
Business Model and Supply Chain	Market channels	The proportion of total blueberry sales made through different market channels	• The most common market channels used by growers were direct sales to consumers and sales to processors • While 19/31 sold an average of 36% of berries direct to consumers, 22/31 sold an average of 82% to packer/processors (with most of that being exported internationally) • 14 growers sold 90% or more of their blueberries to processors	Though direct sale is the most common, growers are selling most of their berries to processors
	Contractual agreement	Whether or not growers had a contractual agreement to guarantee a market outlet for their blueberry sales	• 13/31 have contractual agreements with a packer/processor • These were mostly year-year, and specified amount, quality and food safety standards	Many growers had a contract with a packer/processor that they would make at the beginning of the season, but most did not
	Waste & loss	The proportion of the year's crop that was estimated to be wasted or lost prior to sale	• No growers reported having any post harvest losses of berries – even damaged or low quality berries will be processed for juice or jam • Most loss occurs during the picking process, where it was consistently estimated that 10-15% was lost by machines, and 5-10% lost by hand picking	Due to sophisticated processing systems, very little waste occurs post-harvest. Losses occur during picking, and machines drop more berries on the ground than hand labourers.
Institutions and Networks	Extent of participation in socio-political processes	The number of meetings attended annually	• 23/31 growers participate by attending meetings • Some estimated attending up to 50 meetings • The average among participants who attended meetings (not including those who attended 0 meetings) was 13.3 meetings per year • Of those choosing not to participate, the most common reason was a lack of time	The majority of participants participate in socio-political governance processes through attending meetings. For those who choose to participate, the time commitment is relatively significant, as the average participant was attending 13 meetings per year.
	Perceived empowerment of participation	The extent to which growers felt that these processes gave them a voice in matters relevant to their livelihood	• 14/21 said that this participation gave them a voice • 4/21 responded “somewhat” • 3/21 responded “not really” • 1/21 responded “no”	Of those who are participating in these processes by attending meetings, most feel that it gives them a voice in matters relevant to their livelihood

Category	Indicator	Description of variable measured	Results	Conclusions
	Farm certification	Whether or not farms were certified by any third-party certification body	• 25/33 farms were at least part certified by a third-party certification body • 11/33 were certified organic, with 2 of these being only part certified 18/33 were certified by a food safety program, either Good Agricultural Practices (GAP) certified (15) or PRIMUS (3)	Third party certification was extremely common among growers, but there are significant differences between the two third-party certification types. Many processors require the food safety program certification, which is one reason it was so common among conventional growers.
Labour and Occupational Health	PPE use	Whether or not growers provided access to Personal Protective Equipment (PPE), and whether or not workers use it	• All growers using any form of inputs reported providing access to PPE for themselves and their employees • 3/31 reported that "my employees are always offered appropriate protection but sometimes don't use it"	While all owner/operators of farms interviewed said they provide access to PPE, not all employees are using it all of the time. Of the farms sampled in this study, this was a small minority (most growers reported that employees always use PPE).
Labour and Occupational Health Grower Livelihoods	Reported incidents/accidents (workers)	The number of reported incident or accidents on the farm in the last 5 years	• Only 1 farm reported one incidence of medical attention needed among workers • 3 farms reported work-related injuries occurring on the farm (1, 4 and 5 incidents)	Work-related exposures and injuries were not commonly reported among the farms included in this sample, but were still present
	Standards wage paid to workers	The standard wage (either hourly or piece work wage) reported as being paid to workers	• Wages on farms were either hourly or piece wage (by pound of harvested blueberries) depending on the nature of the labour • Average hourly wage ranged from $10.49 (minimum wage) and $20 per hour, with an average of $12.64 per hour • Price per pound varied from 45 cents to 1 dollar, with an average of 57 cents per pound	There was significant variation in the wages paid to workers on farms in this sample. While there was little or no difference between wages paid to workers on organic certified vs. conventional growers, 'no spray' growers paid workers a full 12 cents higher per pound than those that used pesticide inputs (both organic and conventional)
	Proportion of income from agriculture	The proportion of household income that comes from off-farm sources	• Proportion of income from agriculture reported by growers varied from -20% to 100%, with an average of 38% • The average proportion of income from blueberry agriculture was 30.7% • 23/33 were getting equal to or less than 50% of their income from agriculture • 9/33 were getting 2% or less from blueberries	The majority of farms in this sample were getting at least half of their income from off-farm sources, and many reported being dependent on off-farm income for the farming business.
Grower Livelihoods	Self-reported satisfaction with income from agriculture	Growers' self-reported satisfaction with their level of income from agriculture	• 15 were 'satisfied' with their income from agriculture, 5 were 'somewhat satisfied', and 11 were 'unsatisfied'	Responses from growers were concentrated on either end of the spectrum in terms of their satisfaction with income from agriculture. The level of satisfaction with income from agriculture was generally correlated with the proportion of income from agriculture
	Type of land tenure	Proportion of land in different tenure systems	• 25/33 growers own 100% of their land • 1 grower was leasing 100% of land used	Most growers are accessing land via ownership, but some are also using leasing as a way to access land without the same capital investments