IDENTIFYING CRITICAL KNOWLEDGE, SKILLS AND TEACHING METHODS FOR TRAINING NEW FARMERS IN ALTERNATIVE AGRICULTURAL PRACTICES THROUGH A DACUM FRAMEWORK

by

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IDENTIFYING CRITICAL KNOWLEDGE, SKILLS AND TEACHING METHODS FOR TRAINING NEW FARMERS IN ALTERNATIVE AGRICULTURAL PRACTICES THROUGH A DACUM FRAMEWORK

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Abstract

Majority of Canadian farmers are approaching retirement age with the average age of farm operators being 55 years (Statistics Canada, 2017a). Concomitantly, the dominant global-industrial agricultural model they are predominantly versed and engaged in threatens the sustainability of our food system via extensive detrimental environmental, economic and social impacts. 'Alternative agriculture' offers means of food production that protects or enhances natural resources and ecosystems, imbues climate resiliency, enhances local-regional food security and economies, and can enhance social equity. The transition to alternative agriculture, will require more farmers in absolute terms, and they must be trained in alternative (to the industrial model) farming practices. The objective of this study was to develop a curricular and pedagogical framework to support the training of new alternative agriculture farmers in the province of British Columbia (BC), Canada. A modified Developing a Curriculum (DACUM) process was used to identify the core duties, tasks and associated instructional techniques for the occupation of alternative farm operator in BC. Study results include a comprehensive DACUM chart describing the (15) duties and (213) tasks associated with the occupation of alternative farm operator in BC; a list of knowledge, skills and behaviours/attitudes associated with the occupation and detailed instructional techniques that describe effective methods for training new-entrants. The results of this study can guide and support existing and emergent alternative farmer training initiatives by providing a comprehensive framework for consistent curricula and program development and delivery grounded in the realities of alternative farming in the province.

Lay Summary

Global-industrial agricultural practices have resulted in devastating environmental and social outcomes that render our food system unsustainable. A shift to alternative agricultural practices is required to meet the food needs of a growing population amidst challenges such as climate change, natural resource depletion, biodiversity diminution, and political-economic uncertainty. This will require many farmers trained in alternative agricultural methods. Research on how to comprehensively train new farmers in alternative agricultural practices is sparse. This study, focused on the province of BC, Canada, aimed to identify the essential instructional (curricular and pedagogical) components that should inform new farmer training programs in alternative agriculture. Results comprehensively describe the occupation of alternative farm operator in BC in terms of duties and tasks and outline effective instructional techniques for teaching such duties and tasks – providing a framework for further curricular and pedagogical development for alternative farmer training programs in the province, and elsewhere.

Preface

I conceptualized the idea for this study through the work I do at the Institute for Sustainable Food Systems (ISFS), Kwantlen Polytechnic University, training new alternative farmers. I led the design of the project with close mentorship from my co-supervisor Dr. Kent Mullinix and in collaboration with organizational partner, Véronik Campbell from the Center for Sustainable Food Systems (CSFS) at the UBC (University of British Columbia) Farm. The idea to use the DACUM methodology to guide this investigation came from the work of Claire Strader and Julie Dawson and their creation of the Organic Vegetable Grower Apprenticeship in Wisconsin (Livingston et al., 2018). Preparation for research activities was supported by my colleagues at the ISFS and KPU, my supervisors Dr. Kent Mullinix and Dr. Maja Krzic and my committee members Dr. Will Valley and Dr. Samson Nashon. The DACUM workshop was led by myself with support from my colleague at the ISFS, Emily Hansen who acted as note taker. I led the survey design process with close input from my co-supervisor Dr. Kent Mullinix. My colleagues at the ISFS tested the survey and recommended revisions prior to its distribution. The CSFS at the UBC Farm, ISFS staff and research assistant Lincoln Saugstad assisted with survey distribution. All data from the DACUM workshop and survey was analyzed by myself. I completed final reporting with guidance and editing support from my co-supervisors Dr. Kent Mullinix and Dr. Maja Krzic.

The work in this thesis is currently unpublished. A manuscript reporting on this research and findings will be prepared and submitted for journal publication post thesis acceptance. Dr. Kent Mullinix and Dr. Maja Krzic will be listed as co-authors.

This project was approved by the UBC Behavioural Research Ethics Board (BREB), Certificate #H19-01205 and the KPU Research Ethics Board, File #2019-59.

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List of Abbreviations

BC	British Columbia
CSA	Community Supported Agriculture
CSFS	Center for Sustainable Food Systems
DACUM	Developing a Curriculum
ISFS	Institute for Sustainable Food Systems
KPU	Kwantlen Polytechnic University
UBC	University of British Columbia

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I would like to thank my co-supervisor Dr. Kent Mullinix for helping this project come to fruition. From conceptualizing the project, finding funding and supporting me at each step of the research and writing process, you have provided continued mentorship and support. Thank you for providing me with this opportunity for immense personal and professional growth.

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Thank you to all of the alternative farmers in BC and beyond for spearheading food system change. I hope the results of this project support you in the training work you tirelessly commit yourselves to each season.

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Lastly, thank you to my family for supporting me in getting to where I am today. Without your continued support, love and encouragement I would not be here.

Dedication

To the farmers that tirelessly commit themselves to the work of feeding their communities and modeling a more sustainable food system. Thank you for paving the way. I hope the results of this project can support you in the training you commit yourselves to each season.

1 Introduction

1.1 General Introduction

In the 21st century we face numerous global threats to our food supply including climate change, resource depletion, ecosystem collapse and a declining population of farmers. The contribution of the global-industrial agricultural model to these various global threats matched with its failure to solve global hunger issues, have caused many to question its ability to sustain food production into the future. Many are calling for an alternative agricultural system to meet food demands; one that sustains natural resources, reduces greenhouse gas emissions, creates vibrant local economies and enhances food security and sovereignty. This type of alternative food system will require more farmers that are trained specifically in alternative techniques. This in turn will require the development of comprehensive training programs and curricular and pedagogical materials to support them. This study was focused in British Columbia (BC), Canada and sought to identify the core components to be included in curricular and pedagogical materials to support the training of new alternative farmers in the province.

1.2 The Global-Industrial Agriculture Problem

We face imminent global dangers such as climate change, resource depletion and unprecedented ecological degradation that threaten our food supply and very existence on this planet (Brown, 2012; Qualman, 2019; Rees, 2019; Vermeulen et al., 2012). These global threats exist within the context of a rapidly expanding global population (Brown, 2012; United Nations, 2015), a population that will continue to eat and exacerbate the challenge (Brown, 2012; Lang & Heasman, 2015). In order to mitigate the impacts of these global issues and ensure our ability to feed a growing population, we must re-examine the way in which we grow our food.

The global-industrial agricultural model has been the dominant food production paradigm since its advent approximately 60 years ago in the so-called Green Revolution (Mullinix et al., 2019). This model was developed in response to the threat of mass famine in developing countries due to a sudden population boom (Vermeulen et al., 2012). The Green Revolution has been praised for averting widespread hunger via the introduction of new technologies that increased agricultural output quickly; primarily for the staples: wheat, corn and rice (Evenson, 2003). These technologies included: high-yield-crop cultivars (hybrids), synthetic fertilizers and pesticides, irrigation, and increased mechanical cultivation (Carolan, 2018; Feder & O'Mara, 1981). Despite its widespread adoption, the global-industrial model has been largely unsuccessful in solving the global hunger problem and is to blame for many of the environmental, economic and social crises that threaten our food supply today (Barker, 2007; Carolan, 2018; Holt-Giménez, 2019; Kimbrell, 2002).

The list of environmental harms resulting from industrial agricultural practices is long. Arable land is rapidly being lost due to harmful farming practices (Brownlee, 2016; Holt-Giménez, 2019; Horrigan et al., 2002). Excess tillage has led to the depletion, erosion and compaction of topsoil (Brown, 2012; Holt-Giménez, 2019; Horrigan et al., 2002). Poor irrigation practices have resulted in once fertile land now being too saline and waterlogged to grow food (Horrigan et al., 2002). It is not only arable land that is being degraded by industrial agriculture. Our air and water are also being polluted by the chemical pesticide and fertilizer inputs used in these industrial systems (Horrigan et al., 2002). For example, the Environmental Protection Agency states that agriculture is responsible for 70% of river and stream pollution in the U.S. (Horrigan et al., 2002); pollution, resulting from chemical fertilizer and pesticide runoff, soil erosion and animal waste products (Horrigan et al., 2002; Kimbrell, 2002). Chemical pollutants

in our air and water damage not only human and ecosystem health through elevated cancer rates, eutrophic dead zones and species decline (Kimbrell, 2002), but they also impact our ability to access freshwater to irrigate crops (Horrigan et al., 2002).

Chemical pollution is not the only threat to freshwater reserves. In many areas, aquifers relied upon for human consumption and crop irrigation, are being depleted faster than they can be replenished (Brown, 2012; Brownlee, 2016; Horrigan et al., 2002). The pollution and depletion of freshwater by agriculture is deeply troubling, especially considering that agriculture uses approximately 70% of the world's freshwater for irrigation activities (Brown, 2012; Horrigan et al., 2002). This is even more troublesome considering that only 45% of the freshwater applied to crops is actually taken up by those crops – the rest leaches through the soil as toxic runoff, further polluting waterways and resulting in eutrophic dead (hypoxic) zones (Horrigan et al., 2002). At alarming rates, industrial agriculture is depleting and polluting the resources we rely upon to grow food, drastically harming human, non-human and ecosystem health in the process.

Global commodity focused monocrop practices, which predominate the global-industrial agricultural system, have resulted in a steep decline in both genetic and ecosystem biodiversity (Holt-Giménez, 2019; Horrigan et al., 2002; Kimbrell, 2002). This is manifested in species decline due to mass habitat destruction and agrichemical pollution (FarmFolkCityFolk, 2019; Horrigan et al., 2002), both of which have had a tremendous impact on the pollinator populations and beneficial species we rely upon for crop pollination and pest control (FarmFolkCityFolk, 2019; Horrigan et al., 2002). Monocrop agriculture has also resulted in a rapid loss of genetic diversity in food crops. An estimated 90% of the world's agrobiodiversity has been lost due to monocropping and chemical use (Holt-Giménez, 2019). The reduction in this genetic bank is

frightening when we consider the impacts of climate change, pests and diminishing fresh water reserves on crop production. What is more, our crop plant genetic reserves, the traits that may help us combat these complex environmental forces, are now in control of a few transnational agribusiness corporations that dominate the industry with a handful of genetically engineered and hybrid cultivars (Barker 2007; Drucker, 2015; Hansen et al., 2020).

All of these harmful, externalized environmental transgressions are not only contributing to the loss of soil, freshwater and biodiversity, but they are also significant contributors to climate change. The global food system is one of the leading contributors to greenhouse gas emissions, accounting for 19-29% of global anthropogenic greenhouse gas emissions; agricultural activities accounting for 80-86% of these emissions (Moreau et al. 2012; Vermeulen et al., 2012). Much attention has been given to the large distances our food travels from farm to fork; and the resulting CO_2 emissions from fossil fuel combustion from trucks, planes and ships to transport it. But agriculture-related greenhouse gas emissions sources come not just from transporting food products across the globe. Greenhouse gases are emitted in almost every step of getting our food from farm to plate. Take corn for example; in the US (the world's leading corn producer) (Shahbandeh, 2020), 92% of corn is genetically engineered (U.S. FDA, 2020). This genetically engineered corn seed is created in a lab fueled by fossil fuel energy. To plant the corn, farmers combust diesel fuel in tractors to till the land (releasing carbon from the soil in the form of CO_2); seed the corn; apply nitrogen fertilizer (emitting nitrous oxide – a potent greenhouse gas) along with other chemical fertilizers, pesticides and herbicides; and harvest the crop. This corn is then shipped to a processing plant, where it is made into value-added consumer products or silage; before being transported to its final destination. The carbon footprint of this corn becomes much greater if you consider the methane emitted after it has made its way through

a cow's digestive tract. Fossil fuels are used in every step of our food chain. Further, fossil fuels are a finite resource, and this reliance on fossil fuel energy is not only unsustainable, but it will be unfeasible in the very near future (Pfeiffer, 2006; Rees, 2019).

Not only is agriculture a leading contributor to climate change, it is also one of the sectors that will be most adversely impacted. Agriculture is a climate dependent activity, meaning that crop yields are highly vulnerable to changes in the climate and subsequent weather patterns (Perez et al., 2015; Vermeulen et al., 2012). Global temperatures are predicted to rise between 3 and 5°C by the mid-21st century (Perez et al., 2015). With this rise in temperature, precipitation patterns are predicted to shift – influencing the amount, seasonality and intensity of rainfall (Crawford & Beveridge, 2013; Perez et al., 2015; Vermeulen et al., 2012). These changes in temperature and precipitation are likely to result in annual variation in crop yields (Crawford & Beveridge, 2013; Perez et al., 2015). In some regions, this will mean devastating crop loss due to drought, in others, crop loss due to increased rainfall (Perez et al., 2015). Changes in temperatures will also change the geographic range of pests, resulting in farmers being forced to protect their crops from new and unfamiliar pest outbreaks (Crawford & Beveridge, 2013). Climate change will exacerbate the environmental unpredictability farmers already face, affecting farmer livelihoods and global crop yields. If we are to mitigate these impacts, we must reduce carbon emissions and prevent further temperature rise.

The global-industrial agricultural paradigm has not only fomented disastrous environmental outcomes, but it has resulted in devastating social and economic impacts as well. We are currently seeing both an increase in diet-related diseases (heart disease, cancer, diabetes, and obesity) (Brownlee, 2016; Carolan, 2018; Lang & Heasman, 2015), as well as widespread hunger across the globe (Holt-Giménez, 2019). Over one billion people on the planet today are

hungry (Holt-Giménez, 2019) and 1 in 10 are food insecure (Hansen et al., 2020); yet we produce 1.5 times more food than is required to feed the planet (Holt-Giménez, 2019). It is estimated that 30-50% of our food is wasted along the food chain (Holt-Giménez, 2019). These numbers refute the global-industrial model's claim that producing more food, using industrial methods, is the only way to feed the world. Contrary to the scarcity myth, we do not need to produce more food to feed the planet, we need to increase food access amongst the less affluent (Barker, 2007). Recent research points to the redistribution of wealth and food sovereignty as ways in which to solve the world's hunger problem (Barker, 2007; Hansen et al., 2020; Kimbrell, 2002). Focusing on issues of food access, food sovereignty and wealth redistribution rather than increasing global output, could also go a long way in solving diet-related diseases (Hawkes, 2015).

The industrialization of agriculture has also had devastating effects on rural communities (Francis, 2006; Hassebrook, 2006; Holt-Giménez, 2019). Industry consolidation has resulted in big farms getting even bigger, while small and medium-scale farms have been getting smaller or disappearing altogether (Holt-Giménez, 2019). In North America, consolidation has resulted in the disappearance of 'farms in the middle' and traditional family farming (Kirschenmann et al., 2008). Large farms and farms in general, have increasingly come under corporate control (Barker, 2007; Holt-Giménez, 2019). In 2014, eight firms owned 60% of the market share of seeds/genetic material, machinery, agrochemicals and pharmaceuticals (Holt-Giménez, 2019). Loss of farms and thus farm work, has resulted in a massive shift in the workforce from rural to urban (Barker, 2007). In the early 1900s, farmers comprised approximately 40% of the U.S. workforce, now they comprise less than 2% (Barker, 2007); the numbers are similar in Canada (B.C. Food Security Task Force, 2020; Statistics Canada, 2017a). Industry consolidation and

corporate ownership has resulted in the impoverishment, diminution and economic marginalization of rural communities (Qualman, 2019).

Global free trade agreements and commodity agriculture have had devastating socioeconomic effects on the global South (Latin America, Asia, Africa, and Oceania) as well (Barker, 2007; Holt-Giménez, 2019). Subsidies put in place by Northern governments, encourage farmers in the North to overproduce (Barker, 2007). When Northern economies are unable to absorb this excess, the surplus is dumped in the South, where it undermines agricultural economies and food independence (Barker, 2007). Furthermore, global trade agreements are focused on producing and trading food commodities (Barker, 2007). This has resulted in a shift from subsistence and regional focused agriculture/food systems toward growing commodity crops for export markets (Barker, 2007). The result for rural communities is the loss of local economies, loss of livelihood for many farmers, compromised nutrition, increased hunger and the environmental destruction that accompanies industrial agriculture (Barker, 2007).

Farming communities in the North have also been adversely impacted by neoliberal trade policies (Barker, 2007). In Canada, farm debt nearly doubled after the Canada-US Free Trade Agreement was signed in 1989 (Barker, 2007). Even though Canadian exports nearly doubled in the ten years following the ratification of the agreement, farmers' income declined by 19% (Barker, 2007). The economic benefits resulting from these global trade policies, fell into the hands of the few agribusinesses with control over the market, leaving farmers and rural communities with increased displacement, poverty and debt (Barker, 2007; Hansen, 2020; National Farmers Union, 2019).

The externalized costs of our global-industrial agriculture and food system are extensive. It is devastating to our environment, leading us down a fast track toward a climate emergency, increasing food insecurity and destroying rural communities. This model of producing food, has not only failed to solve the world's hunger problem, but it has created such urgent environmental and socio-economic calamities that we have no reasonable choice but to change how we grow our food. This is, if we have any chance of feeding a growing global population into the future without destroying the very basis of agriculture (Brown, 2012; Rees, 2019).

1.3 Alternative Agriculture

In response to the negative environmental, social and economic impacts from global-industrial agriculture, numerous grassroots movements countering conventional agri-food have emerged (Horrigan et al., 2002; Issac et al., 2018; Lang & Heasman, 2015; National Research Council, 1989; Vandermeer, 1995). The term *alternative agriculture* is commonly used in the literature to encompass these counter-movements that include: sustainable, organic, regenerative, agroecological, ecological, biodynamic, holistic, low-input farming, and others. (Edwards et al., 1990; National Research Council, 1989; Vandermeer, 1995; Zeunert & Waterman, 2018). Alternative agriculture promotes production models that emphasize environmental conservation and stewardship, economic profitability and social equity (Hendrickson et al., 2008; Horrigan et al., 2002; Lichtfouse et al., 2009; National Research Council, 1989; Vandermeer, 1995). It also focuses on tackling global issues such as climate change, resource depletion and ecosystem degradation (Altieri, 2009; Edwards et al., 1990). Alternative agriculture uses various production practices to achieve these objectives. These include but are not limited to a holistic management approach, an emphasis on long-term conservation and sustainability, integrated and diversified production models, reduction of off-farm and non-renewable inputs, ethical and sustainable

livestock production, a focus on social equity, and direct-to-consumer sales (Altieri, 2000; Hendrickson et al., 2008; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989; Vandermeer, 1995).

In contrast to the reductionist paradigm characteristic of the global-industrial model, alternative agriculture uses a holistic management approach (Altieri, 2000; Hendrickson et al., 2008; Horrigan et al., 2002; Magdoff, 2007; Vandermeer, 1995). This holistic approach is sometimes referred to as agroecology, a practice that applies ecological principles to agricultural systems (Magdoff, 2007). Agroecological farming systems are designed based on the ecosystem principles of efficiency, diversity, self-sufficiency, self-regulation, and resiliency (Magdoff, 2007). In the agroecological approach, problems such as pest outbreaks and nutrient deficiencies are viewed as symptoms of an unhealthy or out of balance system (Altieri, 2000). Rather than spraying pesticides to control pest outbreaks, Integrated Pest Management (IPM) principles are followed to mitigate pest outbreaks and reduce the impact when they arise (Altieri, 2000; Horrigan et al., 2002; National Research Council, 1989). In IPM, biodiversity on the farm is increased through habitat creation in the form of hedgerows, set-asides, cover crops, and crop rotations to increase the presence of natural predators in the agroecosystem (Magdoff, 2007; Wezel et al., 2014). Other IPM techniques such as removing crop material from the field after harvest, increasing airflow between crops, selecting resistant crop cultivars, and practicing crop rotations are employed to further reduce pest pressures (Magdoff, 2007). Simultaneously, a diversity of crop species is incorporated into the crop plan to increase the economic resiliency of the farm business if a pest outbreak occurs (Magdoff, 2007). Similarly, holistic soil management techniques are used to conserve and regenerate topsoil (Altieri, 2000; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014). On-farm nutrient cycling

strategies such as planting green manures, cover crops and applying organic composts and animal manures, are used to build soil organic matter and sustain long-term soil health and fertility (Altieri, 2000; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014). The management of nutrients and pests using holistic and agroecological practices increases the efficiency and self-sufficiency of the farming system by meeting nutrient and pest management requirements internally and reducing reliance on off-farm inputs (Gliessman, 2015; Wezel et al., 2014). Furthermore, these practices increase resiliency by incorporating ecosystem principles such as diversity and self-regulation into production models, reducing overall crop loss due to environmental factors (Gliessman, 2015).

Alternative agriculture focuses on long-term conservation and sustainability as opposed to just short-term yields and profits (Hendrickson et al., 2008; Horrigan et al., 2002; Lichtfouse et al., 2009; National Research Council, 1989; Vandermeer, 1995). In alternative systems, the conservation of essential natural resources such as soil, water and biodiversity is prioritized in order to sustain food production in the long-term (Altieri, 2000; Lichtfouse et al., 2009; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014; Vandermeer, 1995). Practices such as cover cropping, mulching and reduced tillage are used to protect topsoil from erosion and compaction (Altieri, 2000; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014). Precision irrigation techniques such as drip tape irrigation in conjunction with soil moisture monitoring are used to prevent waterlogging of soils (Altieri, 2000; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014). Nutrient cycling techniques are used to build soil organic matter and increase soil biological activity, improving soil structure and building nutrient-rich topsoil for sustained crop growth (Altieri, 2000; Hendrickson et al., 2008; Horrigan et al., 2002; Magdoff, 2007; National

Research Council, 1989; Wezel et al., 2014; Vandermeer, 1995). These practices not only protect arable land from being damaged or lost but also sustain soil health over the long-term, they also reduce reliance on harmful agrichemical inputs (Altieri, 2000; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014). Freshwater resources are protected in alternative agricultural systems by reducing contamination from agrichemical inputs and preventing nutrient leaching into waterways (Magdoff, 2007). Riparian areas are protected by maintaining riparian habitat or planting perennial crop buffers that create a barrier between crop production and waterways (National Research Council, 1989; Wezel et al., 2014). Nutrients are applied efficiently to crops and soil is kept covered with vegetation to reduce nutrient leaching (National Research Council, 1989; Magdoff, 2007). Furthermore, the use of synthetic fertilizers is minimized, preventing harmful chemicals from leaching into freshwater sources (National Research Council, 1989; Wezel et al., 2014).

The conservation and enhancement of biodiversity is also central to alternative agriculture. On-farm habitat for native species in the form of hedgerows, set-asides, cover crops and riparian areas is established and/or conserved to promote ecosystem biodiversity (Magdoff, 2007; Wezel et al., 2014). Agrichemical use is minimized or eliminated to protect off-target ecosystem species from pesticide poisoning and water bodies from eutrophication (Wezel et al., 2014). Soil biodiversity is enhanced through practices such as reduced tillage, cover cropping, mulching, green manures, and otherwise building soil organic matter (Magdoff, 2007). Cumulatively, these practices protect essential natural resources from degradation, mitigate environmental damage and ensure that agriculture can be practiced into the future.

Alternative agriculture not only protects ecosystem biodiversity, but it also integrates biodiversity into its cropping systems to increase resiliency and productivity. This is done

through practices such as planting multiple crop species within the farm and farm fields, integrating livestock with crop production, poly-cropping, and agroforestry (Altieri, 2000; Hendrickson et al., 2008; Horrigan et al., 2002; National Research Council, 1989; Vandermeer, 1995). The diversification of crop production using these techniques increases the resiliency of the system by mitigating total crop loss due to environmental factors such as pest and disease outbreaks (Hendrickson et al., 2008; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989). Furthermore, planting multiple crop species more efficiently takes advantage of environmental niches in the farm environment providing nutrients, water and space (Altieri, 2009). The diversification of crop production also establishes multiple revenue streams within the farm business, reducing economic risk and increasing revenue generation potential (Altieri, 2000; Hendrickson et al., 2008; Horrigan et al., 2002). Lastly, crop diversification reduces off-farm inputs when multi-species crop rotations are implemented that promote nutrient cycling, disrupt pest cycles and alternate crop nutrient demands (Hendrickson et al., 2008; Wezel et al, 2014).

In contrast to the industrial approach, which relies heavily on off-farm inputs, alternative agriculture reduces the number of inputs in the system (Gliessman, 2015; Horrigan et al., 2002; Pretty et al., 1996). When off-farm inputs are required to meet crop or livestock nutrient demands or to solve pest outbreaks, local, organic and renewable inputs are prioritized (Isaac et al., 2018; Magdoff, 2007, Pretty et al., 1996). Chemical fertilizers inputs are reduced or eliminated by building soil fertility into the farming system via cover crops, green manures, organic composts, and animal manures (Altieri, 2000; Hendrickson et al., 2008; Horrigan et al., 2002; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014; Vandermeer, 1995). Pest control inputs are reduced by using IPM principles to manage pests as opposed to strict

reliance on synthetic pesticides (Altieri, 2000; Magdoff, 2007; National Research Council, 1989; Wezel et al., 2014; Vandermeer, 1995). Pesticides are only used if outbreaks have reached an economic threshold, in which case, products are selected to minimize environmental harm. Biologically based strategies and materials are preferentially used. (Magdoff, 2007; Mullinix et al., 2010; Wezel et al., 2014). Similarly, when on-farm nutrient cycling falls short of meeting crop and livestock demands, organic, non-GMO and locally produced amendments and/or feed are prioritized (Altieri, 2000; Magdoff, 2007; Wezel et al., 2014). Seed inputs are also selected based on environmental and social values. In general, GMO seeds are avoided and organically produced seed is purchased when available (Government of Canada, 2021). Many farms also plant heirloom varieties, regionally produced and/or seed saved on the farm (Altieri, 2009). In these ways, alternative agricultural systems reduce reliance on off-farm inputs and mitigate adverse environmental impact of inputs when used.

Alternative agriculture often integrates crop and livestock production to increase efficiency, cycle nutrients, reduce environmental impact and improve animal welfare. Alternative agriculture employs rotational grazing systems that move livestock through nutrient-dense pasture (Horrigan et al., 2002; Isaac et al., 2018). Rotational grazing benefits the soil by adding fertility in the form of animal manure and reducing soil erosion by maintaining vegetative cover (Horrigan et al., 2002). Livestock grazing on crop fields also contributes to weed and pest control, reducing management time as well as pesticide and herbicide need (Hendrickson et al., 2008; Ismail, 2009). Nutrient-rich pasture mixes can also supplement livestock feed, reducing the cost and environmental footprint associated with livestock production (Undersander et al., n.d.). These grazing systems not only lead to reduced fertilizer, herbicide, feed and labour requirements but also have the potential to increase crop yields by increasing soil fertility and

reducing competition from weeds (Hendrickson et al., 2008; Ismail, 2009). Animal welfare is also improved in rotational grazing systems (Undersander et al., n.d.). Space allocated per animal is generally much greater than in industrial systems, reducing the degree of disease and behavioral issues associated with confined conditions (Horrigan et al., 2002, Undersander et al., n.d.). Human health is also benefited, as the use of antibiotics is minimized, through practices that reduce the prevalence of disease, thus reducing the development of antibiotic-resistant bacteria that threaten human health (Carolan, 2018; National Research Council, 1989).

Alternative agriculture creates local food economies by concentrating sales near production. Farm products are sold in the community through direct marketing practices such as farmers markets, Community Supported Agriculture (CSA) programs, restaurant sales, and other direct-to-consumer outlets (Altieri, 2009; Edwards et al., 1990; Magdoff, 2007). If farm products are not sold via direct-to-consumer means, market channel supply chains are localized and greatly shortened. This creates and retains wealth locally, contributing to the economic autonomy and vitality of farming communities (Altieri, 2000). Farmers benefit economically from this model as they capture the entire food dollar and receive a premium price associated with their local organic-regenerative products (Magdoff, 2007). Consumers also benefit with increased access to healthy, locally produced foods and an increased sense of connection to their food system (Brownlee 2016; Magdoff, 2007). These local food economies contribute to the revitalization of communities through job and business creation, economic stimulation and increased community networking (Altieri, 2009; Brownlee, 2016; Mullinix et al., 2021). Furthermore, local food economies can contribute to bridging the divide between urban and rural communities by increasing food system engagement amongst both producers and consumers (Brownlee, 2016).

Food sovereignty is a central principle of the alternative agriculture movement (Altieri, 2009; Edwards et al., 1990; Isaac et al., 2018; Pretty et al., 1996). The concept of food sovereignty comes from the global peasant movement, La Via Campesina, and is defined as "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Food Secure Canada, n.d.). Food sovereignty has seven pillars: 1) focuses on food for people; 2) builds knowledge and skills; 2) works with nature; 3) values food providers; 4) localizes food systems; 5) puts control locally; and 6) food is sacred (Food Secure Canada, n.d.). Food sovereignty is a movement pioneered by Indigenous communities and thus, advocates that Indigenous knowledge be uplifted to increase the resiliency, sovereignty and cultural relevancy of local food systems (Altieri, 2009; Food Secure Canada, n.d.; Pretty et al., 1996). Indigenous perspectives are integral to the development of regional alternative agricultural systems as they emphasize the interdependence of human health and well-being with that of Mother Earth and thus advocate for sustainability and respect when working with the land (Mullinix, 2015). Further, engaging Indigenous perspectives is seen as a way to contribute to meaningful reconciliation between local Indigenous and settler communities (Mullinix, 2015). Thus, the engagement of Indigenous communities in alternative agriculture can contribute to greater food system sustainability and increase social justice within the food system by enhancing local food sovereignty and security (Mullinix, 2015).

Critics of the alternative agriculture model(s) claim that it is inefficient, unprofitable, unaffordable and unable to feed the world. These critiques are largely based upon industrial measures and interpretations of efficiency, profitability and global hunger (Altieri, 2009; Kimbrell, 2002). Industrial measures of efficiency often disregard inputs and base yield

measurements on the output of a single monocrop (Kimbrell, 2002). This measure disregards the number of resources and energy to produce the crop, it also bases yield measurements on monoculture systems and does not take into account the diversified nature of alternative farms (Kimbrell, 2002). When efficiency measures consider the total inputs used to grow the crops and measure total output in terms of the yield of all crops grown on an acreage, alternative systems are more efficient (Kimbrell, 2002; Rodale Institute, 2011).

Others argue that alternative agriculture is not profitable when compared to industrial systems. These measures of profitability; however, do not account for government subsidies or externalized costs, which are inextricably linked to the industrial model (Kimbrell, 2002). For example, in the US, 41% of farm income in 2001 came from government subsidies (Magdoff, 2007). In comparison, alternative agriculture receives very little government funding (Horrigan et al., 2002). Industrial agriculture's heavy reliance on government subsidies suggests that most industrial farms would not be profitable without the support of government aid (paid by funds from tax revenues). We also pay high prices for the environmental and social externalities caused by industrial agriculture (Holt-Giménez, 2019; Kimbrell, 2002). These externalized costs are felt in our healthcare system, the devastation of rural communities and environmental catastrophes (Holt-Giménez, 2019; Horrigan et al., 2002; Kimbrell, 2002). Therefore, when the true cost of industrial food is assessed, alternative agriculture appears to be far more profitable than industrial agriculture.

Critics of alternative agriculture argue that local, alternative food products are unaffordable. The commodification and subsidization of industrial food products, results in them often being cheaper and more available than healthy, local alternatives, but does not reflect the true cost of production (e.g. subsidies, and detrimental environmental impacts per above)

(Kevany, 2020). The prevalence and low price of industrial food products leads to poor diet outcomes for rural, poor and Indigenous communities that lack access to healthy alternatives (Kevany, 2020; Wendimu et al., 2018). Alternative agriculture critiques the commodification of food products in the industrial food system and argues that food should be treated as a public good in order to increase access and affordability (Kevany, 2020). The reframing of food as a public good, will require a philosophical shift amongst food system players, but would reduce inequality in the food system and likely result in the reduction of diet-related disease and other poor health outcomes associated with the commodification of food products (Kevany, 2020).

Industrial agriculture proponents argue that it is the only model that can feed a growing population (Holt-Giménez, 2019). These arguments are based on an industrial concept of yield and ignore the socioeconomic factors that contribute to food insecurity. The industrial model measures productivity in terms of the yield of a single crop, often pointing to industrial systems producing the higher yield when compared to alternatives (Altieri, 2009; Kimbrell, 2002). However, when productivity is measured in terms of total harvestable product, accounting for the wide variety of crops grown in diversified farms, alternative farms produce the higher yield (Altieri, 2009). Furthermore, alternative systems reduce yield variability by diversifying farm products, resulting in productivity being more stable under environmental fluctuations (Altieri, 2009). Using these measures, numerous reports have documented that small alternative farms can produce enough food for a growing population, even in the midst of global threats such as climate change, declining oil supply and environmental degradation (Kirschenmann, 2010; Rodale Institute, 2011). Industrial agriculture proponents also ignore the socioeconomic factors affecting food access and security around the world. It is well known that we currently produce enough food to feed the world and global hunger is not the result of a lack of productivity (Holt-

Giménez, 2019; Kimbrell, 2002). Rather, socioeconomic access and poverty are considered to be the main determinants of global food insecurity (Holt-Giménez, 2019; Kimbrell, 2002; Kirschenmann, 2010). Alternative farms place a strong emphasis on mitigating socioeconomic inequality and poverty, addressing the root causes of global hunger. This is exemplified in food sovereignty initiatives that aim to concentrate food system power and wealth in the hands of the agrarian communities in order to improve their socioeconomic outcomes (Altieri, 2009).

Alternative agricultural systems address many of the environmental and social externalities caused by industrial agriculture. They conserve and regenerate the natural resources on which farming relies (soil, water, and biodiversity), redistribute power within regional agricultural communities and improve economic conditions for food producers. They also address many of the external threats that jeopardize our food supply. Greenhouse gas emissions from nitrogen fertilizer applications, manure holdings, heavy mechanization and transportation over long distances are all greatly reduced (Horrigan et al., 2002; Rodale Institute, 2011). Climate change resiliency is built into production models through planting a diversity of crop species, maintaining crop genetic diversity, adapting systems to local environments and mitigating reliance on fossil-fuel inputs (Altieri, 2009). Reliance on non-renewable inputs is mitigated, meeting the majority of pest and fertilizer requirements on the farm and using renewable, environmentally sustainable and local sources when inputs are required. Lastly, land areas used for agriculture are regenerated rather than degraded through practices such as building topsoil, eliminating harmful chemical use and protecting ecosystem biodiversity. Given the imminent threats of climate change, resource depletion and environmental degradation, alternative agricultural systems and practices must be adopted to feed a growing global population.

1.4 More Farmers Needed

The debate over *how* we will feed the world in the midst of numerous global crises, is met with the question of *who* will feed the world? Industry consolidation, and agricultures economic marginalization, as a result of the global-industrial agricultural model, has resulted in fewer farmers working the land in recent decades and increasing dependence on temporary foreign labour (BC Food Security Task Force, 2020; Statistics Canada, 2017a). Today, Canadian farmers represent less than 2% of the population (Statistics Canada, 2017a). This is compared to 33% of the population in 1921 (BC Food Security Task Force, 2020). This already small number continues to decline as aging farmers retire and exit the sector (Statistics Canada, 2011). The 2016 Census of Agriculture reported that farm operators in Canada are rapidly approaching retirement age, with the average age of farm operators at 55 years (Statistics Canada, 2017a). By 2025, one in four Canadian farmers will be 65 or older and within the next decade, 37% of the agricultural workforce will be on track to retire (RBC, 2019). Further, the majority of these farmers do not have plans to pass on their operations, with only 8.4% of farm operators reporting a written succession plan in the last Census (Statistics Canada, 2017a). These trends are similar in the US and parts of Europe (Monllor, 2012; Serkoukou, 2014). These statistics suggest that intergenerational land and knowledge transfer is for the most part, no longer occurring on Canadian farms. This is corroborated by labour trends in the agricultural sector. The labour shortage in Canada's agricultural sector is growing as aging farmer populations intersect with increasingly urbanized population (BC Food Security Task Force, 2020; RBC, 2019). Canadian Agricultural Human Resources Council expects that approximately 123,000 jobs in the sector, in the next decade, will not be filled by Canadians (RBC, 2019). This will likely increase Canada's dependence on Temporary Foreign Workers in order to fill employment gaps (Government of Canada, 2021b). An increased reliance on Temporary Foreign Workers to sustain Canada's

agricultural industry may exacerbate workforce instability if geopolitical relationships are to change, given that foreign workers often don't possess permanent residency or citizen status (Pennel et al., 2020). Further, it may perpetuate inequitable and exploitative treatment of workers if documented transgressions such as inadequate housing, lack of status, access to adequate healthcare, regular inspections and reporting, and indentureship are not first addressed (Pennel et al., 2020). This decline in farmers and skilled farm workers and increased reliance on Temporary Foreign Workers for agricultural work, is troubling as we face the challenge of feeding a growing global population in the face of various environmental crises that threaten our food supply. It should compel us to ask, why agriculture is not seen as a viable profession? Regardless, to meet food production goals in the 21st century, we need to grow the agricultural workforce and increase the number of new-entrants in the sector. These new-entrants need to be trained in alternative agricultural practices given the inadequacy of the global-industrial model in mitigating global threats and sustaining agricultural production into the future. The switch to alternative agricultural practices will require even *more* farmers participating in food production compared to the global-industrial model, thus comprehensive and widely available education and training will be required (Heinberg, n.d.).

1.5 New-Entrants

Recent food systems research has focused on addressing the issue of aging and declining farmer populations in North America by identifying and describing new farmer demographics (Dennis, 2015; Knibb et al., 2012; Laforge et al., 2018). These studies suggest that there is an emergent demographic of young (under the age of 35) farmers entering North America's agricultural sector (Dennis, 2015; Knibb et al., 2012; Laforge et al., 2018; Schreiner et al., 2018). This is consistent with 2016 Census of Agriculture data that indicates a 3% increase in the

number of farm operators under the age of 35 between 2011 and 2016; the first time an increase has been seen in this age category since 1991 (Statistics Canada, 2017a). The majority of these young farmers are from non-farming backgrounds and are engaged in alternative farming and marketing practices including agroecological and/or organic production and direct, community-focused marketing (Dennis, 2015; Knibb et al., 2012; Laforge et al., 2018; Niewolny & Lillard, 2010; Schreiner et al., 2018). These new farmer groups indicate factors such as lifestyle, creating social change and producing healthy and ecologically friendly food as core motivators for choosing to pursue the profession (Dennis, 2015). Such studies suggest that there is an emerging and growing contingent of new farmers in North America, that did not grow up on farms and are interested in alternative agricultural practices.

This recent trend of new farmers practicing alternative agriculture in North America is concomitant with increased consumer concern around the environmental and social impacts of food production (Carlisle & Miles, 2013; Dennis, 2015; Schreiner et al., 2018). This is reflected in consumer behavior, with an increased demand for organic products seen across Canada. Canada's organics industry is outpacing all other agri-food categories (MacKinnon, 2013), growing from a $3.5billion industry in 2012 to a $5.4billion industry in 2017 (COTA, 2017). Of this growth, British Columbia (BC) generated 23% of the total revenue, while representing only 13% of Canada's total population (MacKinnon, 2013). Based on these numbers, BC is leading the country in per capita organic food sales (MacKinnon, 2013). In BC, two-thirds of customers are purchasing organic products weekly (MacKinnon, 2013). These numbers are even higher in Vancouver, a major market, where 3/4 of customers purchase organic products weekly (MacKinnon, 2013).

The agriculture industry is responding to the increased market demand for organic products (COTA, 2017). This is demonstrated through conventional farmers adopting organic production practices and new farmers entering the sector as organic producers (COTA, 2017). Of all the provinces, BC and Quebec have the largest number of farmers transitioning to organic production methods (COTA, 2017). Land under organic production in the country increased from 70,000 acres to 2.43 million acres between 2014 and 2015 (COTA, 2017). Organic fruit and nut production saw a 50% increase and organic vegetable and root crop production tripled during this time (COTA, 2017). This has resulted in growth in the number of certified organic producers nationally between 2013 to 2015, with an increase from 492 to 562 in BC during this period (COTA, 2017). This increase in demand for organic products in BC and Canada, could partially explain the recent uptick in new-entrants to Canada's agricultural industry focused on alternative and/or certified organic practices.

Another factor that may be contributing to the increase in new-entrants that are focused specifically on alternative agricultural practices, are the high barriers to entry associated with the commodity agriculture and supply management systems that currently dominate Canada's agricultural industry (Pouilot, 2011). Industrialization and industry consolidation has resulted in a drastic increase in the capital required to operate an industrial-scale farm, making it difficult to enter the industry (Pouilot, 2011). In BC, quota prices associated with supply managed industries such as dairy, poultry and egg production are often prohibitively high, preventing new farmers from purchasing quota and entering the industry (Pouilot, 2011). Pouilot (2011), believes these barriers, matched with an increasing demand for local, organic food, may partially explain why many new-entrants are choosing to enter the industry as local or organic food producers (Pouilot, 2011). The local, organic sub-sector generally requires a smaller start-up capital investment

compared to commodity and supply-managed industries, making it more feasible for new farmers (Pouilot, 2011). Furthermore, the increased consumer demand for local, organic products, makes it attractive to new farmers. This increased consumer market demand for local, organic food, matched with the sub-sectors potential to decrease barriers to entry for new farmers, strengthens the argument for training new-entrants in alternative agricultural practices. Not only will this contribute to meeting consumer demand for these products locally, but it also has the potential to reverse Canada's aging farmer problem, regenerate agricultural land, revitalize farming communities and mitigate further environmental degradation.

1.6 New-Entrant Training

Despite an urgency for agricultural reform, a need for new-entrants into North America's agricultural industry and an increasing demand for organic food, training opportunities and other support services are lacking for new farmers (deLa Rosa et al., 2021; Dennis, 2015). Given the criticality of new-entrants to North America's agricultural industry and the fact that many new farmers are no longer being trained inter-generationally on family farms, recent studies have sought to ascertain how new farmers are obtaining training and what their preferred methods of training are. Schreiner, Levkoe, and Schumilas, (2018) identified and categorized existing farmer training options in North America. Through a comprehensive literature review, the authors developed a typology to describe the existing training initiatives in North America. Through their research, the authors identified five distinct categories of training models including: informal farm internship associations, centralized internship programs, private and non-profit course-based programs, formal academic programs and independent, self-directed learning. These training models all had different approaches to training and varied in their curricula, standards, modes of delivery and formality. Furthermore, these training models were unevenly distributed

throughout North America, influencing the type of training available regionally. Schreiner et al. (2018) concluded that although farmer training is of high importance in North America, knowledge regarding appropriate and effective program formats and development is lacking. The authors stated that there is a need for more research to be done in this area based on the strong interest they encountered amongst farmers, researchers and practitioners. They concluded saying they hoped their work would inspire further development of high-quality practical farmer training programs.

Similarly, Niewolny and Lillard (2010) summarized new farmer initiatives, in the United States (US), focused on teaching sustainable agriculture. The authors conveyed the impetus for their research stating, “beginning farmer training and program development in the United States is one of the most significant yet poorly understood areas of agriculture, food system, and community development research and practice" (Niewolny & Lillard, 2010, p. 66). The authors conducted a literature review of 33 new farmer initiatives in the US between 1999 and 2009 that they found to demonstrate best practices. The authors’ review focused on programs that held a primary focus on education or training, offered continual education (not one-off opportunities), contributed substantially to farmer training and had a focus on adult, beginning farmer audiences. In their review, the authors identified numerous initiatives coming from both the public and private sector. The majority of programs focused on teaching sustainable agriculture practices and generally included five core content areas: production practices, marketing, financial planning and resource assistance, business planning and management, and land acquisition and transfer. The programs were found to not just teach the skills and knowledge of farming but also engaged students in affective skill development (the ways in which we interact emotionally via feelings, emotions and attitudes). Program structures varied between Internet-

based learning opportunities, on-farm experiential learning programs and apprenticeship models. Many of the programs were place-based, specifically serving certain regions or communities. Pedagogical approaches included: participatory learning through short courses and workshops, farm incubator programs and apprenticeship programs. Programs emphasized local farmer knowledge through farmer-led training, hands-on and experiential learning methods, on-farm training and goal-evaluation. These approaches and emphases varied in scope and depth but were common across many initiatives. Similarly, the mix of and integration between in-class courses and on-farm learning varied amongst programs.

Niewolny and Lillard (2010) concluded that this beginning farmer phenomenon and the associated training initiatives are contributing to the construction of an alternative knowledge system at local, regional and national levels. This knowledge system is predominantly focused on teaching sustainable agriculture through informal education models that emphasizes experiential and peer-to-peer learning. However, they maintain that sustainable agriculture and beginning farmer education remain at the margins of research and education agendas, recommending that meaningful programming continue to be developed for new farmers. In doing so, the authors recommended that participatory and experiential learning methods, which integrate knowledge and practice and that limit the amount of traditional lecture-based education, should be substantially employed.

Sheils and Descartes (2004), worked with new farmers in the northeast US, to identify training gaps and propose targeted programs to better meet new farmer needs. The authors worked with new farmer groups to develop a new farmer typology that identified six continuous stages that new and beginning farmers go through prior to establishment. These stages split into two distinct categories: ‘new farmer’ and ‘beginning farmer’. The ‘new farmer’ category

describes farmers that are in the earliest stages of entry and includes the categories of: recruits, explorers, and planners. The 'beginning farmer' category describes farmers that are further along in the entry process and includes the categories of: startups, re-strategizers, and establishers. The authors argue that each stage of the typology has different learning needs and preferences, and therefore programming should target specific new farmer groups within their typology. They used this typology in focus groups with local farmers to identify gaps in the various stages of training. For each typology, the authors identified training gaps. At the 'new farmer' level, they found there to be a lack of introductory programs targeted at recruiting new farmers, a lack of hands-on practical training programs and a lack of production information and education. At the 'beginning farmer' level, they found there to be a lack of land access programs, financial and credit services for new farmers, programs focused on market analysis and planning and programs focused on pre-business and business planning. More generally, the authors found a dearth of programs that target minority groups and women farmers.

In these focus groups, they also asked new farmers how they preferred to access training. They found that the majority of new farmers prefer to learn hands-on through programs such as apprenticeships, mentorships, farm tours and peer-to-peer networking. Based on these findings, the authors concluded that programs should be developed with these preferences in mind. Additionally, programs should target specific new farmer groups in specific typologies to better meet various needs. Finally, the authors emphasized that local new farmer groups should be engaged in the program development process to identify regional training gaps to better meet training needs and preferences.

Perez, Parr, and Beckett (2010) sought to assess if the 40-year-old UC Santa Cruz Apprenticeship Program in Ecological Horticulture program was effectively meeting its goals.

To do so, they surveyed former students that had graduated between the years 1989 and 2008. The Apprenticeship Program in Ecological Horticulture is an intensive, residential training program in organic farming and gardening. The program is 6-months long and combines in-field training and classroom education through a structured curriculum. The goal of the program is to train participants in sustainable food production philosophies and techniques. They found that 88% of respondents had worked in the field of sustainable food systems in some way post-graduation, and that 72% were still working in the field. The graduates were also asked what parts of the program they found to be most influential in their development as food systems professionals. Respondents cited hands-on experiential learning, knowledge learned in the classroom, peer-to-peer learning and the shared living environment. From these findings, the authors concluded the importance of developing knowledge and skills through hands-on activities in farmer training programs, specifically field-based training in a peer-to-peer learning environment. The authors also recommended that Kolb's experiential learning theory be incorporated into program models. Kolb's theory of experiential learning states that learners construct knowledge when they create meaning from their experience (Perez et al., 2010). Kolb argues that this occurs through an iterative four-step process: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Perez et al., 2010). The authors further concluded that experiential learning should be integrated with theory, given the graduates emphasis on both being important to their development. The authors note that university programs often emphasize theory over practice and on-farm programs often emphasize practice over theory. However, the responses from graduates suggest that programs can be improved by balancing and integrating the two. The authors further noted the importance of integrating the affective domain in training programs, recommending that programs

emphasize all three domains of learning including the psychomotor, affective, and cognitive. As one of the oldest farmer training programs in sustainable agriculture and given the program's high success rate, the results from this assessment can be used to inform the development and improvement of other similarly focused programs in other regions.

Studies describing and analyzing new farmer training programs in North America are few; however, they offer important insight into the gaps and successes that are manifest amongst existing programs (Niewolny & Lillard, 2010; Perez et al., 2010; Schreiner et al., 2018; Sheils & Descartes, 2004). The results of these studies suggest that farmer training differs widely in its mode of delivery, curricular content, training focus (skills vs. knowledge) and level of formality. Furthermore, training options are not evenly distributed across North America (Niewolny & Lillard, 2010; Schreiner et al., 2018; Sheils & Descartes, 2004). The most effective programs are those that balance skills and knowledge, engage affective learning and are place-based (Niewolny & Lillard, 2010; Parr et al., 2010). Furthermore, programs that emphasize local farmer knowledge and experiential learning via on-farm training and peer-to-peer learning are highly valued (Dennis, 2010; Knibb et al., 2012; Laforge et al., 2012; Niewolny & Lillard, 2010; Parr et al., 2010; Sheils & Descartes, 2004). The results of the studies mentioned above emphasize the need for further research on program development to create high quality, effective training options that meet new farmer needs. These findings should inform the development of future programs in order to fill training gaps and meet the learning needs and preferences of new farmers regionally.

To improve existing training initiatives, studies have focused on asking new farmers to identify how they currently receive training as well as their training preferences (Dennis, 2015; Knibb et al., 2012; Laforge et al., 2018). Dennis (2015), surveyed prospective and beginning

farmers in BC to understand their demographics, training backgrounds and training preferences. The majority of respondents were from non-farming backgrounds and did not learn how to farm inter-generationally on a family farm. They sought hands-on training through volunteering, apprenticing and/or employment on other farms. Of the respondents, 78% had informal agricultural training and farm labour experience and 69% had some form of higher education although not always related to agriculture. Farmer-to-farmer mentoring was the most valued form of training indicated by respondents, which was considered to be a highly valuable resource by 69% of prospective and 72% of beginning farmers. This was in contrast to university or college agriculture degree programs, which were considered to be extremely or highly valuable by only 19% of prospective and 6% of beginning farmers. Furthermore, the majority of respondents were interested in or actively engaged in diversified ecological production, further emphasizing the need for training with this specific focus.

Similarly, Knibb, Learmonth, and Gatt, (2012) asked new farmers in Ontario about the training and educational opportunities in which they were engaged, as well as what types of training they would find most valuable. New farmers reported participation in informal face-to-face learning via volunteering, employment, structured internships or mentorship from experienced farmers. Participants reported interest in workshops, field days and tours, farmer-to-farmer mentorship, agricultural conferences and kitchen table meetings. They expressed their ideal learning environment to include both informal and formal formats, encompassing a combination of both theory and practice. New farmers indicated the most significant barriers to training were: cost, regional access and availability of appropriate resources for their level of experience and region. Based on these findings, Knibb et al. (2012) recommended the development of regional approaches to new farmer training that minimize travel time and cost

and contribute to the development of supportive regional training networks and mentorship opportunities. Furthermore, the authors concluded that the development of training resources that teach alternative agriculture practices is especially needed, as training programs in this sub-sector are new and scant.

These recommendations are consistent with those put forth by Laforge, Fenton, Lavalée-Picard, and McLachlan (2018), who recommended the development of educational and training materials to support mentorship initiatives in alternative agriculture. Laforge et al. (2018) conducted a national survey of 1,326 new, aspiring, exited and experienced farmers across Canada. The purpose of the survey was to explore the challenges and opportunities in the Canadian food and farming system. In this survey, researchers also sought to identify which training initiatives are serving Canadian farmers best and how these could be supported and expanded. Of the survey respondents, 23% were from BC, 23% from Ontario and 22% from Atlantic Canada. The survey findings indicated a potential shift in new farmer demographics in Canada. Most respondents were from non-farming backgrounds of which BC had the highest number. Respondents from non-farming backgrounds were more likely to engage in direct marketing, agroecological production, small-scale production, vegetable production and niche product production. Respondents were asked to rank the value and significance of existing programs and resources for farmers. Informal farm workshops, field days and farm tours ranked highest, followed by on-farm training in the form of apprenticeships, internships and farmer-to-farmer mentorship. The authors noted that new farmer training and mentorship often falls on the shoulders of individual farmers, and there is a need for more support around these initiatives given its high value amongst new farmers. They suggested that farmer training initiatives could be better supported by developing standardized training, educational and accreditation systems.

The authors also noted that incubator farms and farm schools are highly rated amongst populations that have access to them. However, there are few such programs in Canada and therefore more support, funding and development are required. The authors also noted an uneven distribution of training programs focused on teaching alternative agriculture across Canada. Therefore, they concluded that programs focused on alternative agriculture be developed widely with resources to support them. They further recommended that training programs address the major barriers new farmers face such as access to land and capital, low profitability and lack of infrastructure.

1.7 Need for Research

The afore studies identify common barriers to entry for new farmers including a dearth of adequate and comprehensive training opportunities. They also identify learning preferences of new farmers including: on-farm training, farmer-to-farmer mentorship, a combination of theory and practice and regionally appropriate training. Additionally, they point to a lack of training programs and materials in North America that adequately address aspiring or new alternative farmer needs, learning preferences, barriers to entry, and are more widely available. Based on these findings, these studies recommended the development of comprehensive training materials to support program development for alternative farmers.

There has been only a limited amount of research focused on the delineation and development of appropriate training materials to effectively prepare new farmers in the alternative agriculture sub-sector (Niewolny & Lillard, 2010). There is a dearth of information regarding what should be included in curricula that aims to effectively and comprehensively prepare new alternative farmers. Given new generation farmers' proclivity to eschew conventional agriculture and utilize alternative agricultural practices, the urgency in which they

are needed and the absence of teaching resources and programs, appropriate, effective curricula focused on alternative agriculture practices must be developed (Niewolny & Lillard, 2010).

1.8 The DACUM (Developing a Curriculum) Process

DACUM, an acronym for 'Developing a Curriculum', is a tool that uses occupational analysis to develop curricula grounded in the realities of the workplace (Norton, 1997). The DACUM model has been successfully used to design curricula for many vocational-technical programs including formal apprenticeship programs in the agricultural field. The Organic Vegetable Apprenticeship in Wisconsin (Livingston, Strader & Dawson, 2018); the Dairy Grazing Apprenticeship (Livingston et al., 2018); and the Horticulture Technology Program at Kent State University (Halbrooks, 2003) are examples.

Norton (1985) outlines the advantages of the DACUM process as a tool for vocational-technical education curricula development:

1. It is well suited to the development of competency-based education programs by identifying specific tasks that can be used in curricula development;
2. It centers industry representatives as the primary content experts in curricula development. This bases curricula in the realities of the workplace and fosters connections between industry and education programs;
3. The process is quick, effective and inexpensive. (Norton, 1985, pg. 5-7)

The DACUM methodology supports the recommendations of Knibb et al. (2012) and Laforge et al. (2018) that advocate for development of training materials that support *farmer-driven* training. DACUM emphasizes the opinions and perspectives of vocational experts as the

basis for curriculum development (in this case alternative farmers), which is in alignment with the recommendations put forth by Laforge et al. (2018) and Knibb et al. (2012). Basing curricula (and subsequent program development) on the occupational realities of expert alternative farm operators in BC, encourages curricula (and program) development that is up-to-date, fully attuned to the realities of the workplace and regionally relevant (Norton, 1997). Further, the DACUM process helps answer the difficult question when developing curriculum of *what should be taught*? While reducing gaps between what is being taught in the classroom and what is happening in real world environments. It is ideal for curricula development for regionally based, alternative agriculture training programs that seek to prepare new-entrants to be successful in the realities of the field. Thus, this structured, efficient, cost-effective and proven approach to curricula development is a widely accepted and utilized methodology for vocational-technical curricula development (Norton, 1997). The effectiveness and efficiency of the DACUM model in developing vocational curricula, the involvement of community members and the collection of occupationally relevant and localized data, makes it an appropriate method to achieve this study's objectives.

1.9 Study Objectives

The goal of this study was to identify the essential skills, knowledge and instructional techniques that should be included in programs intending to train new farmers in alternative agriculture in order to support the development of effective, comprehensive curricular and pedagogical materials. This study used a modified DACUM methodology to assess and prioritize the perspectives of alternative farmers/farm operators in BC that use alternative agricultural practices. The research question addressed by this study was - What are the core duties and tasks

and associated instructional strategies that should inform alternative farmer training initiatives in BC?

Specific objectives of this study were to:

1. Identify the core duties and tasks associated with the occupation of alternative farm operators in BC.
2. Explore how identified duties and tasks should best be taught and learned to effectively prepare new alternative farmers.
3. Develop a curricular and pedagogical resource, based on findings, to guide and support the development of agricultural education rograms that prepare new alternative farmers in BC.

2 Methods

2.1 The DACUM Workshop

This study followed a modified DACUM (Developing a Curriculum) process. DACUM is a curriculum development approach that uses occupational analysis to develop competency-based, vocational curricula (Norton, 1985). The DACUM process brings together a committee of experts (referred to as the 'Expert Committee') in a given vocation to identify core responsibilities, referred to as 'duties and tasks' associated with their vocation (Norton, 1997). The list of core responsibilities identified by the Committee is used to develop competency-based, vocational-technical curricula that is grounded in the realities of the occupation and workplace (Norton, 1997). The DACUM process is based on the following premises:

1. Expert workers are able to define and describe their occupation better than anyone else;
2. All occupations can be described in terms of duties and tasks that workers perform;
3. All tasks have direct implications for the knowledge, skills, tools, equipment and attitudes workers must have to perform them correctly. (Norton, 1985, pg. 1-2)

2.1.1 Selection of the Expert Committee

The target demographic of this study was 'alternative' farm operators in BC. The inclusion criterion was farm operators (Appendix A-1) that self-identify as using alternative (to industrial) agricultural practices (Appendix A-1). Study participants were recruited from various agricultural regions in BC in order to yield information appropriate for the development of alternative agriculture educational programs across regions in the province.

To assemble the Expert Committee for the DACUM workshop, I used purposive sampling to identify eight farm operators in BC that use alternative agricultural practices, and as

such would readily be identified as alternative farm operators. The vocational definition used to describe and identify occupational experts was - *alternative farm operators* (Appendix A-1). Purposive sampling was required to select a committee of expert farm operators within the province of BC that employed alternative agricultural practices and met the DACUM criteria. The following criteria was used for the selection of vocational experts: technical competence, full-time employment, occupational representation, geographic representation, ability to communicate, ability to cooperate as a team member, freedom from bias and full participation in the DACUM workshop (DACUM handbook, Norton, 1997). Demographic diversity amongst participants was also sought in terms of gender, age and race/ethnicity. Furthermore, alternative farmers that utilized a diversity of production models were selected to ensure vocational representation within the alternative agriculture field. Prioritization was given to farmers that use integrated production models (Appendix A-2). A breakdown of the Expert Committee's demographics and production models is outlined in Table 2.1.

Participants were recruited using the professional connections of the two organizational research partners: the Institute for Sustainable Food Systems (ISFS), Kwantlen Polytechnic University (KPU) and the Center for Sustainable Food Systems (CSFS), University of British Columbia (UBC). I worked collaboratively with various ISFS and CSFS staff to compile a list of farm operators that aligned with the vocational definition and DACUM inclusion criteria. Potential participants were contacted by email, offered reimbursement for travel costs and an honorarium of $400 (Appendix B-1). Those that agreed to partake in the study were sent a letter of informed consent prior to participation (Appendix B-2). They were then sent an email outlining workshop details and given the initial occupational definition to review (Appendix B-3). They were also sent a preliminary list of duties and tasks to review prior to the workshop

(Appendix B-6), a two-week reminder email (Appendix B-4) and a week of reminder email (Appendix B-5).

Table 2.1 Developing A Curriculum (DACUM) Expert Committee Demographic Information

Member	**Self-identified gender**	**Self-identified race/ethnicity**	**Farm size (acres)**	**Production model**	**Geographical region**
Member 1	Female	White	2	Market garden + laying hens	Lower Mainland
Member 2	Female	White	2.5	Market garden	Lower Mainland
Member 3	Female	White	40	Mixed vegetable, livestock	Vancouver Island
Member 4	Female	White/SE Asian	5	Mixed vegetable	Vancouver Island
Member 5	Male	White	6	Mixed vegetable	Pemberton
Member 6	Male	White	60	Mixed vegetable, fruit trees	Okanagan
Member 7	Male	White	7	Livestock (eggs, broilers, turkeys), fruit trees	Okanagan
Member 8	Male	White	5	Mixed vegetable, livestock	Cariboo

2.1.2 DACUM Process Modifications

Following the recommendations of Norton (1997), the following four modifications to the standard DACUM process were made to derive the DACUM chart in a one-day workshop with the Expert Committee.

1. I conducted a comprehensive literature review to compose a preliminary (a) occupational definition of *alternative farm operator* and (b) list of duties and tasks associated with the occupation.
2. I facilitated a DACUM-like workshop with ISFS staff to refine the occupational definition and list of duties and tasks derived from the literature review, (and simultaneously refine my skills as a DACUM facilitator). I prioritized the selection of ISFS staff that most closely aligned with the definition of alternative farm operator so that the session would be as similar to the actual DACUM workshop (to be conducted) as possible. A member of the Teaching and Learning Center at KPU (https://www.kpu.ca/teaching-and-learning) and expert in the DACUM process, guided and trained me in the facilitation process.
3. I sent the Expert Committee the occupational definition and list of duties and tasks derived from the literature review and workshop with ISFS staff to review prior to the DACUM workshop.
4. The Expert Committee reviewed and refined the occupational definition and DACUM chart constructed via the literature review over a single-day DACUM workshop.

2.1.3 DACUM Workshop Context

The DACUM workshop with the Expert Committee took place on January 28, 2020, over an eight-hour period. It was held in a conference room at KPU-Richmond campus sufficient to comfortably accommodate 20 people. It had a large unbroken wall that was used for physically constructing the DACUM chart using large (8”×12”) adhesive note sheets. The room was arranged to encourage ease of communication and participation amongst the facilitator and

Expert Committee members. Committee members were seated behind tables providing a work surface. Tables were arranged in a semicircle facing the brainstorming wall (Appendix C-1) to enhance participant familiarity and interaction. All Committee members were provided name tags and table top placards with their name and farm business name. I (the facilitator), and an assistant, were located at the front of the room closest to the brainstorming wall to readily affix items (adhesive notes, etc.) on it and lead the group discussion. The research assistant took detailed hand-written notes throughout the workshop. Sheets of paper, adhesive tape and pens were used to construct the DACUM chart on the brainstorming wall. Participants were also provided with pen and paper to record individual thoughts and ideas generated during DACUM discourse. A table with light refreshments was set up in the back of the meeting room, which Committee members were invited to avail themselves of at any time and participants were provided lunch during an hour midday break.

2.1.4 DACUM Workshop Overview

The various workshop roles included a facilitator, coordinator, notetaker and the Expert Committee (Table 2.1). A detailed breakdown of each of these roles is provided below.

Coordinator: I planned and coordinated all DACUM workshop logistics and activities. This involved: communicating the study objectives, expectations and results with participants (via e-mail) and responding to all participant questions and concerns.

Facilitator: I functioned as the DACUM workshop facilitator. Responsibilities included: orienting the Committee to the DACUM process, establishing rapport with participants,

facilitating group interaction and participation and leading the Expert Committee through the day-long DACUM session (Norton, 1997). I encouraged all Committee members to offer contributions, share ideas and collaborate, creating a positive dynamic in order to reach group consensus (Norton, 1997).

Note taker: An assistant (ISFS staff volunteer) acted as note-taker for the workshop. This involved: legibly and accurately printing the task and duty statements that Committee members generated on (8”×11”) sheets of paper and fastening them to the DACUM chart wall. The note taker also recorded pertinent information on flip charts during brainstorming sessions (e.g., when refining the occupational definition and identifying skills, knowledge and instructional techniques). The assistant listened attentively (for any needed future reference) to Committee member discussion, followed direction from the myself (the facilitator), and wrote quickly, legibly and accurately (Norton, 1997). At the end of the workshop, myself and assistant transferred all notes into a document for later use (Norton, 1997).

Expert Committee: Eight occupational experts (alternative farm operators), (Table 2.1) comprised the Expert Committee. Their primary role was to describe their occupation in detail, in terms of duties and respective tasks, as directed by me, the facilitator. Other functions included: refining the definition of their occupation, identifying specific skills, knowledge and attitudes required to perform tasks and identifying instructional techniques best suited for alternative agriculture teaching programs.

The DACUM workshop consisted of the following seven sequential stages.

1. *Orientation:* An orientation was given at the beginning of the workshop to reiterate (previously communicated via email) project objectives, workshop details, the role of Expert Committee participants and establish Committee-facilitator rapport. I explained to the Expert Committee my role as facilitator and provided a brief overview of the DACUM philosophy and process that was to ensue. I then introduced the assistant (i.e. note taker), reiterated the Committee's role in the workshop, reviewed again the project objectives, addressed all participant questions and reviewed a detailed workshop agenda. Before the workshop commenced, I asked each Committee member to introduce themselves, tell the group a bit about their farm operation, and share which region of BC they came from. I then asked each member to share with the group the most troublesome pest they encounter on their farm. These introductions and questions were to establish familiarity and rapport between Committee members before beginning the DACUM brainstorming process.
2. *Review of occupational definition:* For the first workshop activity, I led the Committee through the review of the occupational definition developed prior to the workshop. The Committee collectively refined the definition so that it best reflected their occupation from their perspective. The definition established the parameters for occupational analysis in terms of duties and tasks to be included in the forthcoming DACUM chart.
3. *Review of duty statements:* Next, I led Committee members in reviewing the list of duties (presented in statements) associated with their occupation. Duty statements under review were written on pieces of paper and placed in a vertical column on the left-hand side of the brainstorming wall prior to the start of the workshop. Fourteen duty statements were

posted at this time. Each individual duty statement was refined and validated collectively by the Expert Committee.

4. *Review of tasks statements:* During this phase, I led the Committee through each duty statement and asked them to confirm the associated task lists, which had been derived prior from the literature review and pre-DACUM session with ISFS staff. The Expert Committee was asked to further refine and validate the list of tasks, task by task, put forth for each duty statement. Following the structure outlined by Norton (1997), and as communicated to the Expert Committee, each duty statement was to have six or more associated task statements. Task statements could reflect: cognitive skills, motor skills or affective skills (Appendix C-2).
5. *Review and refine task and duty statements:* Once all duty statements and associated tasks had been confirmed, the Committee reviewed all duty and task statements for clarity, precision and relevance. During this process, duty and task statements were modified, eliminated, repositioned or added.
6. *Identify motor, knowledge and affective skills:* The Committee was asked to identify specific psychomotor, knowledge and affective skills required to effectively execute the list of duties and tasks associated with the occupation. For example, themes such as 'hardworking' or 'team player' were outlined by the Committee under affective skills. This was done through an unstructured, group brainstorming session. This group brainstorming process gave the Committee a break from the highly structured DACUM chart development process, and facilitated spontaneous idea generation amongst the group.

7. *Identify instructional strategies:* The last step in the DACUM session was leading the Committee through a group brainstorming session to identify the most effective instructional strategies for teaching the identified duties and tasks. Similar to the identification of psychomotor skills, knowledge and affective skills, this process took the form of a free-form group brainstorm.
8. *Workshop Conclusion:* To conclude the workshop, I thanked Committee members for participating in the study and communicated plans for disseminating results to them. I then ensured that all DACUM materials used in the brainstorming process were carefully filed and recorded so that they could be used later to create the DACUM chart and validation survey. I also asked for volunteers amongst the Committee to participate in reviewing the compiled DACUM chart. This helped ensure DACUM chart accuracy and subsequent validity of the survey created from the DACUM session.

2.1.5 DACUM Workshop Data Analysis

Post-workshop data analysis activities included labeling duty and tasks cards so that they could be more easily used to construct the validation survey. This was done by labeling duty statements with letters (e.g., A, B, C, etc.) and task statements with the letter of their corresponding duty and a number. For example, tasks under Duty "A" were be labeled: A1, A2, A3, etc.; and tasks under Duty "B" were be labeled: B1, B2, B3, etc. The culmination of this process was a DACUM chart that was organized into duty and task statements (Appendix D-1). The organized and labeled cards were used to transfer the DACUM chart into an Excel document. This DACUM chart was then used to create the validation survey.

2.2 Validation Survey

After the DACUM workshop and the development of the DACUM chart, the DACUM workshop outcomes were corroborated via an online survey. The survey was created within 30 days after the DACUM workshop and was based on the resultant DACUM chart. The survey sought to corroborate if (a) the list of duties and tasks accurately reflected the profession of alternative farm operator in BC and (b) if any critical duties or tasks had been overlooked in the DACUM workshop. The survey instrument is included in Appendix E-3.

2.2.1 Participant Recruitment

Participants for the survey were solicited via email lists, website and social media hosts, and face-to-face (Chakrapani & Deal, 2011). I worked with fellow ISFS staff and the research assistant to establish an email list of potential participants that met the project's inclusion criteria and to send an email to those listed inviting participation (Appendix E-1). The two institutional research partners, ISFS and CSFS, also hosted a brief description of the research objectives and a link to the survey on their webpages and social media accounts. Other organizations in the sustainable agriculture sector in BC, such as Young Agrarians, Farm Folk City Folk, and OrganicBC (formerly Certified Organic Association of BC), were approached to promote the survey through their online networks (webpage, email lists and social media pages). Further recruitment took place at conferences and events in BC that were centered around sustainable food systems such as: OrganicBC's annual conference and events hosted by ISFS or the UBC Farm. Further, the research assistant and I identified, through extensive research, farms in BC believed to reflect the target demographic. These farms were directly contacted for participation via email using the contact information provided on their websites. I aimed to garner approximately two hundred completed surveys from alternative farmers in BC. As such,

assuming a 50% response rate, participation was solicited from approximately 400 alternative farmers across BC.

2.2.2 Validity and Reliability

The survey's validity and reliability were established prior to administration by the following means:

1. Reviewed for accuracy, clarity and appropriateness by the Principal Investigator, (Dr. Kent Mullinix) and an ISFS staff. The survey content was adjusted according to their assessment.
2. The survey was piloted to decrease the opportunity for non-sampling error (Chakrapani & Deal, 2011). The two project partner organizations: CSFS and ISFS, recruited eight peers in their organizations, that approximated the study's target demographic, to take part in the pilot survey. I then analyzed the pilot survey data to look for large incidence of non-response and other non-sampling error that may have indicated poorly constructed questions. Based on this feedback and identified errors, I revised the survey and developed a final draft.

2.2.3 Survey Content

The survey was constructed using the online survey tool by Qualtrics (Provo, UT) as required by UBC. The survey consisted of 66 questions and took approximately 15 minutes to complete. At the start of the survey, participants were given a consent document to sign, detailing project objectives, confidentiality and results dissemination (Appendix E-2). As an incentive to complete the survey they were also given opportunity to enter a raffle to win one of

ten $100 Visa giftcards. Participants were asked a series of screening questions at the start to ensure they met target demographic inclusion criteria. If they did not meet the criteria, their participation was automatically terminated.

The survey consisted of three main parts: demographic questions, occupational characterization questions and task verification questions (Appendix E-3).

1. *Demographics:* Respondents were asked their age, gender, ethnicity and highest level of education achieved.
2. *Occupational Characteristics:* Respondents were asked about their occupational title, organizational type and their agricultural training background. They were also asked about their agricultural approach (i.e. method) and types of agricultural enterprises. They were asked to report their farm annual gross revenue, household income from their agricultural business, and farm and crop acreages.
3. *Task Verification:* Respondents were asked to rate the importance of tasks associated with each of the 15 duty areas. Rating options were: important, neutral, not important or unsure. They were also given the opportunity to write-in tasks that they did not see represented in the task lists.

2.2.4 Survey Data Analysis

Survey data were analyzed using Qualtrics data analysis and report generating tools. Before analysis, incomplete surveys were excluded, so that only complete responses remained for

analysis. I then organized the data according to demographic and occupational information, task verification and task write-in responses for analysis.

Task validation ratings: I used the Qualtrics report generating tool to generate reports for all task validation questions. I organized these results into table format to indicate response rates and percentages. I then analyzed responses to determine degree of task validation, using three rating categories of validation. Tasks rated 'important' by over 75% of respondents were considered to have a high level of validation, tasks rated 'important' by 50% to 74% of respondents were considered to have a medium level of validation and tasks rated 'important' by less than 50% of respondents were considered to have a low level of validation.

Write-in tasks: Analysis was facilitated using Qualtrics 'Text iQ' data and analysis tool, which allowed me to code responses using qualitative coding (categorization of responses in order to reveal themes and patterns in the responses). This coding process condensed and summarized the write-in response data into core themes associated with each write-in question. To determine if the write-in themes were distinct concepts (or already represented in the DACUM chart), I compared each revealed theme with the tasks already listed in the DACUM chart. Those write-in themes (tasks) that were determined to be already represented in the DACUM chart were dismissed, so that remaining write-in task themes were new. These themes were then considered for their relevance and importance to the duty area to determine whether they should be added to the DACUM chart. In certain cases, task write-ins were similar to existing tasks in the duty area but offered important nuance or elaboration. In such instances, existing tasks in the chart were edited to reflect the task concept more thoroughly (Appendix F-8).

Demographic and occupational data: I used the Qualtrics report generating tools to generate reports for all demographic and occupational questions. I organized these results into table format to present response rate and percentages. All write-in responses associated with demographic and occupational questions were analyzed using Qualtrics 'Text iQ' data and analysis tool. Using, the Text iQ tool, I coded write-in responses and summarized them in table format.

3 Results and Discussion

3.1. Defining Alternative Farm Operators

The definition of alternative farm operator derived from the literature review was confirmed and revised by the Expert Committee. The definition as confirmed by the expert committee was as follows - ***Alternative farm operators*** were those persons responsible for the day-to-day management decisions made in an agricultural operation. ***Alternative farmers/farming*** was defined as - alternative agricultural practices differ from industrial agriculture in their production methods and marketing channels. Alternative agriculture includes farming systems such as organic, agroecological, biodynamic, regenerative, and sustainable agriculture. Alternative agriculture tends to:

1) Employ ecological growing practices to maximize soil and water health and animal welfare. These include crop rotations, cover-cropping, sustainable soil management, etc.
2) Sell to farmers markets, CSA's, farm-gate, restaurants, food hubs, local groceries, and/or wholesale markets.
3) Exercise business practices that value human, farmworker and community health.

In confirming the above definition, the Committee made three substantive changes to the preliminary definition derived from the literature review (Appendix A-1), and those changes are outlined in Table 3.1.

Table 3.1 Changes to Preliminary Alternative Farm Operator Definition as proposed by the Developing A Curriculum (DACUM) Expert Committee

Changes	**Preliminary definition**	**DACUM[1] committee changes**
Change 1	Ecological growing practices to minimize adverse environmental effects. These include, but are not limited to crop rotations, cover-cropping, sustainable soil management, crop diversity, minimization of synthetic chemical use, etc.	Employ ecological growing practices to maximize soil and water health and animal welfare. These include: crop rotations, cover-cropping, sustainable soil management, etc.
Change 2	Direct-marketing channels such as sales through farmer's markets, CSA[2]s, farm-gate, restaurants, food hubs and/or local groceries.	Sell to: farmers markets, CSA[2]s, farm-gate, restaurants, food hubs, local groceries and/or wholesale markets.
Change 3	Small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies.	Exercise business practices that value human, farmworker and community health.

[1]DACUM = Developing a Curriculum; [2]CSA = Community Supported Agriculture

Two of the changes pertained to scale. The first was the addition of wholesale markets in the definition. The Committee agreed that selling to wholesale outlets is often a necessary sales strategy to access economies of scale and increase economic viability. Despite this addition, the Committee agreed that direct marketing should remain central to the definition. Acknowledging the importance of direct marketing techniques to their own businesses and the broader alternative farming sub-sector. For similar reasons, the Committee elected to remove '*small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies*' from the definition. The Committee argued that scaling up does not inherently compromise the values of alternative agriculture and it can be necessary to achieve economies of scale. This change was contentious as various members argued that small-scale production is a key distinguishing factor between alternative and conventional farms. Further claiming that there

is an overwhelming tendency for alternative farms to operate on a small-scale. Ultimately, the Committee agreed upon the removal of the small-scale statement from the definition to be inclusive of all scales of production. Part of this debate was due to a lack of a clear definition of small-scale. Provided clear parameters, the Committee may have decided to include a statement related to scale in the definition.

The Committee members also elected to add the statement '*alternative farm operators have a tendency to exercise business practices that value human, farmworker and community health*' to the definition. They felt that this statement encompassed the social focus of alternative farms, which was not previously reflected in the definition. This encompasses an important dimension of alternative farms and is reflective of some of the reasons aspiring and beginning farmers in BC state for choosing to farm (Dennis, 2015). This concept was further reflected in the duties and tasks identified by the Expert Committee in the DACUM workshop.

3.2 Identification of Duties

The Expert Committee was asked to identify the core overarching duties associated with the occupation of alternative farm operator. The Committee identified 15 duties as essential to their occupation (Table 3.2).

Table 3.2 Duty Statement Themes as Identified by the Developing a Curriculum (DACUM) Expert Committee

	Duty	**Theme**
1	Manage Farm Business Administration	Business Management
2	Manage Human Resources	
3	Manage Farm Finances	
4	Develop Farm Marketing & Sales Plan	
5	Manage Production of Vegetable Crops	Crop and Livestock Production
6	Manage Perennial Crop Production	
7	Manage Livestock Operations	
8	Manage Harvest and Post-Harvest Handling of Crops	
9	Manage Insect Pests, Weeds, and Diseases	
10	Operate Farm Equipment and Tools	Technical Skills
11	Manage Farm Infrastructure	
12	Steward Soil Health	Resource Management
13	Manage Water Resources	
14	Pursue Professional Development	Social Skills
15	Engage in Community	

The Committee placed a strong emphasis on business management in their list of duties. This is also a common content area in other farmer training initiatives (Niewolny & Lillard, 2010). This emphasis is interesting when compared to the reasons new BC alternative farmers cite for choosing to farm. Dennis (2015) found lifestyle, social change, or producing healthy, good quality food to be the primary motivators of prospective and beginning farmers for choosing a career in farming. Whereas business opportunity, was their least cited motive. This is doubly interesting given the challenge of profitability in small-scale agriculture in BC and elsewhere (Dennis, 2015). The BC Ministry of Agriculture states that within five years of

startup, 70% of small farms either close or change dramatically (Dennis, 2015). These statistics are sobering and suggest that successful business management is essential to new farmers continuing in the occupation long-term. Farmer training initiatives can therefore play a crucial role in ensuring new farmers are comprehensively trained in business management in the early stages of their farming career. Intentional and comprehensive training on the topic could contribute to more farmers staying in the industry past the five-year mark. All Committee members had farmed for over ten years. Their emphasis on business management in their occupations could be a reason for their long-term operational success.

Crop and livestock production was also a predominant focus of the Expert Committee confirming that even at the owner/operator level, alternative farm operators are intimately involved in production activities. These results are consistent with the content of other farmer training initiatives (Niewolny & Lillard, 2010). Similarly, production knowledge is a content area that is sought out by new farmers (Dill & Beale, 2015). It follows that extensive knowledge and skills related to crop and livestock production are required of alternative farm operators and thus this should be a main curricular emphasis.

There was debate amongst the Committee around if the two duties pertaining to social issues (community engagement and professional development), should be included. Some Committee members argued that these duties were outside the scope of running a farm business. However, all members agreed that they have engaged in these duties at some point in their career. Various Committee members even argued that social values were a driving force for pursuing a career in alternative agriculture and that they remain central to their professional pursuits. This is reflective of the motivations prospective and beginning farmers cite for choosing a career in (alternative) farming (Dennis, 2015). The importance placed on social values by new

farmers may suggest that incorporating social content in training initiatives is important in gaining buy in and for reinforcing purpose beyond business. However, the dialogue amongst the Expert Committee may suggest that social initiatives become less prominent in their occupation as their careers progress. Based on this divide, dialogue around balancing the daily demands of farming with the social values that often drive new-entrant to choose a career in farming, may be an important topic to incorporate into training curricula.

Various tasks within these two duty statements were notable in emphasizing the importance of social and political initiatives in the alternative farmer operator occupation. For example, one task was 'acknowledge and engage with local First Nation Communities'. This task is reflective of the importance garnered from the literature around engaging local Indigenous communities in order to enhance food system sustainability, justice and access, and engage in active reconciliation (Altieri, 2009; Food Secure Canada, n.d.; Mullinix, 2015; Pretty et al., 1996). Another task, 'engage with government (e.g. lobbying, policy, programs) points to the political role alternative farmers play in advocating for alternative agriculture and food systems at the local and federal government level. Various other tasks touched on engaging with local communities through education and outreach activities and relationship building. However, tasks centered around enhancing social justice and equity, diversity and inclusion were notably missing from the lists. The absence of these tasks may be in part explained by the predominance of white participants amongst the Committee and survey respondents. However, in order to increase ethnic representation and diversity it is likely important to engage in social justice and equity, diversity and inclusion work. Thus, in order to increase diversity within the sub-sector, these topics should be emphasized in new farmer training agendas.

Ten of the fifteen duty statements started with the verb ‘manage’, there may be various explanations for this. First, the DACUM process calls for each duty and task statement to start with a verb. In the case of duty statements, it can be difficult to find a verb that encompasses all the associated tasks, thus the Committee tended to favor broadly encompassing verbs like ‘manage’. Second, the tight time period in which the DACUM workshop took place may have also contributed to this phenomenon as it made it more difficult to be creative, thus the verbs that first came to mind were often those that were already in use. Third, the prevalence of the verb ‘manage’ in the duty statements may be due to the operational demographics of the Committee. All members of the Expert Committee run successful long-term farm businesses that likely require highly skilled management of all aspects of their operations. This is particularly true given the challenge of profitability in small-scale agriculture in BC. Thus, verb choice and the duties themselves may reflect this reality. Notably, some of the duties that did not start with the verb ‘manage’ were ones pertaining to social initiatives (e.g., *engage* in community and *pursue* professional development), or to natural resource management (*steward* soil health). Thus, the use of ‘manage’ may also relate to the duty content itself, the majority of which pertained to production or business administration. Whereas if there were more duties pertaining to community or natural resources we may have seen a more eclectic assortment of duty statement verbs.

3.3 Identification of Tasks

The expert panel reviewed, revised, identified and reorganized duty tasks (smaller units of work) until a refined list of tasks associated with each of the fifteen duty areas was agreed upon. Between seven and 19 tasks were identified for each duty statement for a total of 165 tasks

comprising the 15 duty areas. The final list of duties and tasks was organized into the DACUM chart format (Appendix D-1) which was subsequently used to construct the validation survey.

3.4 Identification of Motor Skills, Knowledge and Attitudes/Behaviours

The Expert Committee identified various skills, knowledge and attitudes/behaviors required to perform the list of duties and tasks associated with their occupation of Alternative Farm Operator. The various skills pertained to crop production, construction/trades, affective skills, computer/media, finance and business, livestock management and food preparation (Table 3.3). The types of knowledge the Committee identified pertained to plant science, natural resource management, livestock management, business management, pest management, soil science, tools and machinery, food safety and storage, research and procurement and various other categories (Table 3.4). The attitudes and behaviours identified by the Committee included themes of work ethic, social interaction, outlook, rationality and resiliency (Table 3.5).

Due to the freeform nature of the brainstorming session, it is likely that not all skills, knowledge and attitudes/behaviours associated with the occupation of Alternative Farm Operator were represented in the Expert Committee's lists. In order to comprehensively identify a full list of skills, knowledge and attitudes/behaviours associated with the occupation, it would be necessary to review each task in the DACUM chart to ascertain the associated skills, knowledge and attitudes/behaviours. However, this initial list of skills, knowledge and attitudes/behaviours highlights the extensive knowledge and skills required of the Alternative Farm Operator profession and provides a strong foundation for further investigation. Further, the extensive representation in each category (skills, knowledge, behaviours/attitudes) points to the importance of including all three domains of learning (motor, cognitive and affective) in training programs.

Table 3.3 Skills Identified by the Developing a Curriculum (DACUM) Expert Committee

Category	**Skills**
Crop Production	Production tasks
	Horticulture (e.g. pruning)
	Grafting
	Bed preparation
	Sowing seeds
	Propagation
	Tillage/cultivation
	Designing and setting up irrigation systems
	Seed saving
Construction/Trades	Welding
	Tool sharpening
	Basic construction
	Basic electrical
	Basic carpentry
	Basic plumbing
	Basic mechanical
	Greenhouse construction
	Tool operation
	Machinery operation
	Trellis construction
Affective	Verbal communication
	Written communication
	Problem solving
	Networking
	Staff management
	Time management
	Literacy
	Organization
	Conflict resolution
	Computer literacy
Computer/Media	Word processing
	Excel
	Design
	Social media
Finance/Business	Basic math
	Financial literacy
	Basic research
	Accounting
	Short and long-term planning
	Record keeping
	Market analysis
Livestock	Butchering
	Slaughtering

Food Preparation	Culinary

Table 3.4 Knowledge Identified by the Developing a Curriculum (DACUM) Expert Committee

Category	**Knowledge**
Plant Science	Botany
	Plant Diseases
	Crop Families
	Plant Biology
	Crop Suitability
	Plant Physiology
	Weed Management
	Season Extension (e.g. greenhouses)
	Crop Post-harvest Physiology
	Crop Specific Requirements
	Plasticulture
	Seed Saving
	Plant Life Cycles
Natural Resource Management	Site Evaluation
	Agricultural Capabilities
	Climatology
	Geography
	Resource Availability
	Climate Appropriate Crops
	Local Wildlife
	Climate Change
Livestock	Animal husbandry
	Livestock physiology
	Pasture management
	Animal breeds
	Animal diseases and wellbeing
	Animal behaviour
	Animal waste/manure
	Animal nutrition
Business Management	Market analysis
	Financial literacy
	Employment standards
	Costs
	Organic standards
Pest Management	Integrated Pest Management (IPM)
	Entomology
	Pest and disease lifecycles
	Approved pest control methods
Soil science	Soil science (chemical, biological, physical components)

	Composting
	Amendments
	Cover crops
Tools and Machinery	Tool functions and uses
	Mechanics
	Irrigation technologies
Food Safety and Storage	Food safety concepts
	Proper crop storage
Research and Procurement	Working with suppliers
	Sourcing materials
	Data collection
Other	Ergonomics
	Culinary
	Local policies and regulations
	Environmental issues

Table 3.5 Attitudes and Behaviours Identified by the Developing a Curriculum (DACUM) Expert Committee

Category	**Attitudes/Behaviours**
Work ethic	Hardworking
	Determined
	Perseverance
	Motivated
	Efficient
	Independent
Rationality	Pragmatic
	Realistic
	Discerning
	Critical thinker
Resiliency	Innovative
	Resourceful
	Thrifty
	Resilient
	Adaptable
	Visionary
Social	Culturally/socially aware
	Friendly
	Neighbourly
	Empathic
	Accommodating
	Team Player
	Mentor
	Community engagement
	Open-minded

	Respectful
Outlook	Optimistic
	Intrepid
	Hopeful
Other	Patient
	Safe
	Organized
	Change-making
	Confident

3.5 Validation Survey Sample Demographics

A total of 174 alternative farmers completed the validation survey, which was close to the goal of 200. Twenty-five percent (n=43/170) of respondents were under the age of 35 (Table 3.6). This is a much higher proportion than the 6.9% of farm operators reported in the latest provincial Census (Statistics Canada, 2014a), suggesting that there are more young farm operators engaging in alternative agriculture than in agriculture at large. This supposition is difficult to verify as *alternative* farm operators are not distinguished in the Census. Despite this, various studies on new farmer groups in BC, Canada and North America seem to support this (Dennis, 2015; Knibb et al., 2012; Laforge et al., 2018; Schreiner et al., 2018).

In contrast, 26% of respondents were over the age of 55 (Table 3.6). Thus, an almost equal number of young farmers and farmers approaching retirement age responded to the survey. This is a lesser proportion than reported in the latest provincial Census of which 58% of farmers were over 55 (Statistics Canada, 2014a). These results suggest, that there are fewer alternative farmers approaching retirement age compared to farmers in the province at large. Overall, it may be that the alternative farmer population in BC is younger than the general farmer population in the province.

Table 3.6 Ages of Alternative Farmers Who Responded to the Validation Survey

Age	Number of respondents	Percentage of respondents (%)
Under 25	4	2.35
25 to 35	39	22.94
36 to 45	47	27.65
46 to 55	35	20.59
56 to 65	30	17.65
66+	15	8.82
Total Count	170	100

Sixty-five percent (n=109/169) of respondents identified as female (Table 3.7). This is consistent with the findings of other studies on alternative farmer populations in Canada (Laforge et al. 2018) and Ontario (Knibb et al., 2012). This is a much higher proportion compared to the latest Census data, which reported female operators to make up only 29% of all Canadian farm operators (Laforge et al. 2018) and 37.5% of BC farm operators (Statistics Canada, 2014b). These finding indicate the preponderance of women in the alternative farming movement in BC; hence, it seems reasonable that training programs and materials should reflect this gender shift. This raises the question – how to achieve this? In the least, acknowledging the historical and contemporary male dominance in the industry at large and ensuring that alternative farming training programs address potential associated prejudices and barriers seems appropriate, but this was not something that was brought up by the Expert Committee.

Table 3.7 Genders of Alternative Farmers Who Responded to the Validation Survey

Gender	Number of respondents	Percentage of respondents (%)
Male	46	33.14
Female	109	64.50
Other	4	2.37
Total Count	169	100

Most respondents were white (82%; n=135/165) (Table 3.8). This is consistent with the findings of Dennis (2015) who observed that events geared towards alternative and beginning farmer in BC were predominantly attended by white participants. The 'whiteness' of the alternative agriculture movement has also been documented in the U.S. (Alkon & McCullen, 2011). Introspection as to the lack of ethnic diversity in the alternative farm operator occupation is important in order to reduce barriers for minority groups. To increase ethnic diversity in alternative agriculture, training initiatives should strive to reduce systemic barriers and increase opportunities amongst diverse ethnic groups. Ensuring that curricula is relevant, culturally appropriate, safe and appealing is also an important step in increasing ethnic representations in the sub-sector.

Table 3.8 Ethnicities of the Alternative Farmers Who Responded to the Validation Survey

Ethnicity	**Number of respondents**	**Percentage of respondents (%)**
White	135	81.82
Black or African American	0	0.00
Asian	8	4.85
Indigenous or First Nations	5	3.03
Hispanic or Latino	1	0.61
Métis	7	4.24
Other	9	5.45
Total Count	165	100

Fifty-eight of respondents reported completing some sort of higher education (n=98/169) (Table 3.9), of which a bachelor's degree was reported by the largest strata of respondents. Conversely, 42% of respondents reported that they had not completed any form of higher education (n=71) (Table 3.9). Other studies on new alternative farmer populations in Canada show even greater levels of higher education, with 69% of new alternative farmers in BC (Dennis, 2015) and 71.5% of new farmers in Ontario (Knibb et al., 2012). These higher rates

may be due to those study's focus on *new* alternative farmers, whereas this study surveyed alternative farmers inclusive of all tenure levels. The results of this study, in combination with those on new farmer groups, may suggest that new alternative farmers have higher levels of education than members of the sub-sector at large.

Even though 58% of respondents reported completing some kind of higher education, only 17% reported higher education related to agriculture. These findings are consistent with Statistics Canada (2013) data indicating Canadian farm operators under the age of 35 were more likely to have some post-secondary education (59.5%) than those over the age of 35 (50.9%) (Statistics Canada, 2013). However, farm operators under the age of 35 were less likely to hold a post-secondary degree related to agriculture (20.5%) compared to operators over the age of 35 (41.8%) (Statistics Canada, 2013). These results seem to imply that new-entrants are not seeking agricultural training through traditional higher education programs (i.e., agriculture degrees) even though most have completed some form of higher education. It may also suggest that agricultural degree programs are not widely available (particularly those focused on alternative agriculture) or that agriculture is not prioritized as a pursuit of study compared to other degree programs. These results are consistent with those of Dennis (2015); Knibb et al. (2012); and Laforge et al. (2018) who found new-entrants to prefer modes of training that exist outside of formal institutions. However, the high rates of postsecondary education amongst new alternative farmer groups may have implications on how training materials should be developed and delivered. Given these high rates of post-secondary education, alternative farmers are likely well-versed in the theoretical/formal types of learning found in academic institutions. Therefore, integration of theory into training programs and curricula is likely to be well-received and can provide opportunities to make connections between field experiences and academic knowledge.

Table 3.9 Education Levels of Alternative Farmers Who Responded to the Validation Survey

Education	Number of respondents	Percentage of respondents (%)
Some secondary, no diploma	8	4.73
Secondary diploma or equivalent	14	8.28
Some college credit, no degree	24	14.20
Trade/technical/vocational training	21	12.43
Bachelor's degree (e.g. BA, BSc)	60	35.50
Master's degree (e.g. MA, MSc, MEd)	25	14.79
Professional degree (e.g. MD, DDS, DVM)	4	2.37
Doctorate degree (e.g. PhD, EdD)	9	5.33
Other	4	2.37
Total Count	169	100

Most respondents indicated that they were farm owner/operators (80%; n=125/169) (Table 3.10). Occupational descriptors that came up in the 'other' category included: gardener, instructor, and student.

Table 3.10 Occupational Titles of Alternative Farmers Who Responded to the Validation Survey

Occupational Title	Number of respondents	Percentage of respondents (%)
Farm owner/operator	135	79.88
Farm manager	9	5.33
Farm worker	11	6.51
Other	14	8.28
Total Count	169	100

Most respondents (83%; n=123/148) said they operated a private business. Other respondents indicated they worked for a non-profit, university, charity, government or institute (Table 3.11).

Table 3.11 Organizational Types of Alternative Farmers Who Responded to the Validation Survey

Organizational Type	Number of respondents	Percentage of respondents (%)
Private business	123	83.11
University	10	6.76
Government	4	2.70
Institute	4	2.70
Non-profit	24	16.22
Charity	9	6.08
Other	8	5.41
Total Count	182 choices / 148 respondents	100

Most respondents preferred the term sustainable agriculture to describe their farming practices (72%; n=120/167), followed by regenerative agriculture (47%; n=79) and alternative agriculture (41%; n=69) (Table 3.12). Additional nomenclature offered in the 'other' category included: permaculture, organic, uncertified, pasture raised, humane livestock, sustainable/ecological but uncertified, traditional indigenous agriculture, urban farm, family farm, and no tillage. Less than half of respondents reported being certified organic (40%; n=67).

Table 3.12 Agricultural Approaches of Alternative Farmers Who Responded to the Validation Survey

Agricultural Approach	Number of respondents	Percentage of respondents (%)
Sustainable Agriculture	120	71.86
Regenerative Agriculture	79	47.31
Agroecology	28	16.77
Certified Organic	67	40.12
Biodynamic	28	16.77
Alternative Agriculture	69	41.32
Other	31	18.56
Total Count	167	

Dennis (2015) also found ecological production and organic methods to be valued by new farmers in BC but organic certification less so; 86% of beginning and young farmers reported striving to follow organic practices, but only 14% were certified. In addition, Dennis (2015) also found respondents to be interested in practices such as permaculture, biodynamics, and agroecology. These results indicate the diversity of language used to describe alternative agricultural practices amongst practitioners. This can make it difficult to define agricultural practices associated with the various approaches and ideologies. However, given the diversity of names used to describe similar practices, the use of an encompassing term such as alternative agriculture seems appropriate. It is also interesting that many practitioners do not seem to be concerned with being certified organic even though their practices may align with organic principles. Recent legislation in the province around the use of the term 'organic' may influence producers' decision to certify in the future. In 2018, the province made 'organic' a protected label for agricultural products so that the term can only be used by producers that hold organic certification (Government of B.C., n.d.). Certification requires producers to comply with the organic standards and associated requirements such as annual inspections and documentation of practices (Government of B.C., n.d.). Producers that do wish to certify based on these legislation changes will require training and knowledge of the organic standards and requirements. Thus, incorporating training around organic standards and requirements into farmer training agendas can help producers familiarize with the certification process and make an informed decision on if they want to certify.

Most respondents reported growing vegetable crops (80%; n=137/171) and perennial crops (63%; n=107), whereas fewer farmers were engaged in small-scale livestock production

(43%; n=74) (Table 3.13). A variety of other enterprises were noted in the 'other' category, reflecting the diversity of crops and enterprises that comprise the alternative agriculture sub-sector. These included cut flowers (n=10), nursery crops (n=5), apiary (n=3), seed crops (n=3), covercrop (n=2), hay (n=2), value-added crops (n=2), wild foods (n=2), fungi (n=1), greenhouse crops (n=1), hemp (n=1), herbs (n=1), hops (n=1), and traditional medicine (n=1).

Table 3.13 Agricultural Enterprises of Alternative Farmers Who Responded to the Validation Survey

Agricultural Enterprises	Number of respondents	Percentage of respondents (%)
Livestock (e.g. pigs, chickens, goats, cattle)	74	43.27
Vegetable crops	137	80.12
Tree fruits/small fruits and/or other perennial crops	107	62.57
Grain/oil crops	5	2.92
Forage crops	35	20.47
Other	37	21.64
Total count	171	-

The enterprises comprising the 'other' category were only employed by a few respondents. Ten respondents reported producing cut flowers and 5 respondents reported growing seed crops, while all other enterprises in the 'other' category had less than 3 respondents associated. This suggests that although these enterprises are employed by some alternative farmers in BC, they remain more on the margins of alternative agriculture practices. Given that it is difficult to encompass all these enterprises in the scope of a curricula/farmer training program, alternative agriculture programs may do well to focus on the most widely practiced methods employed and crops/stock produced by alternative farmers. Additionally, curricula and training programs should be adapted to specific regional contexts, incorporating methodologies and crop/stock types that are relevant to place and new farmer interest.

Of 148 respondents, 39% (n=58/148) reported a gross revenue between $10,000 to $40,999, representing the largest strata of respondents. The second largest strata of respondents reported their farm revenue as less than $10,000 (20%; n=29). A complete summary of the annual gross revenue of respondents is presented in (Table 3.14).

Table 3.14 Annual Gross Revenue of Alternative Farmers Who Responded to the Validation Survey

Annual Gross Revenue	**Number of respondents**	**Percentage of respondents (%)**
Less than $10,000	29	19.59
$10,000 to $40,999	58	39.19
$50,000 to $99,999	25	16.89
$100,000 to $149,999	16	10.81
$150,000 to $199,999	6	4.05
$200,000 to $249,999	4	2.70
$250,000 to $299,999	4	2.70
$300,000 and above	6	4.05
Total Count	148	100

Of 155 respondents, 67% (n=104) reported that their farm business revenue makes up less than half of their household income and 16% (n=25) reported it to be 100% of their household income (Table 3.15).

Table 3.15 Percentage of Household Income from Farm Business of Alternative Farmers Who Responded to the Validation Survey

Percentage of Household Income from Farm Business	**Number of respondents**	**Percentage of respondents (%)**
0%	21	13.55
1-25%	56	36.13
26-50%	27	17.42
51-75%	9	5.81
76-99%	17	10.97
100%	25	16.13
Total Count	155	100

The USDA defines small farms as those that make less than $250k in gross annual revenue and receive most of their household income from off the farm (Ahearn & Newton, 2009). By this measure, 97% of respondents operate small farms. Most respondents (59%; n=87) are not just operating small farms, but are operating very small farms (less than $40,999). These results may be concerning when profitability is considered. Ahearn and Newton (2009) found that on average, farms that generate less than $50k per year lose money. Similarly, Statistics Canada reported that farms that generate an annual revenue of less than $100k a year, on average have a negative net income (Statistics Canada, 2012b).

The struggle of profitability of small farms is further emphasized by the number of respondents reporting large amounts of off-farm income (Table 3.15). Reliance on off-farm income was similarity reported by Dennis (2015) who found 78% of new farmers and 94% of prospective farmers in BC indicated currently or planning to generate off-farm income. Similarly, Statistics Canada reported many Canadian farms reliant on off-farm income as farm debt rises (Statistics Canada, 2012b). Ahearn and Newtown (2009) argue that the proportion of off-farm income is correlated to farm size, stating “the larger the farm, the greater the on-farm income; the smaller the farm, the greater the off-farm income”. Further, the authors state that most small farms (those generating less than $250k in sales a year), report most of their income coming from off-farm. These statistics emphasize the challenge of economic viability for small-scale farms and may point to the need for increased training and support resources for small-scale alternative farmers in order to increase their economic viability and sustainability.

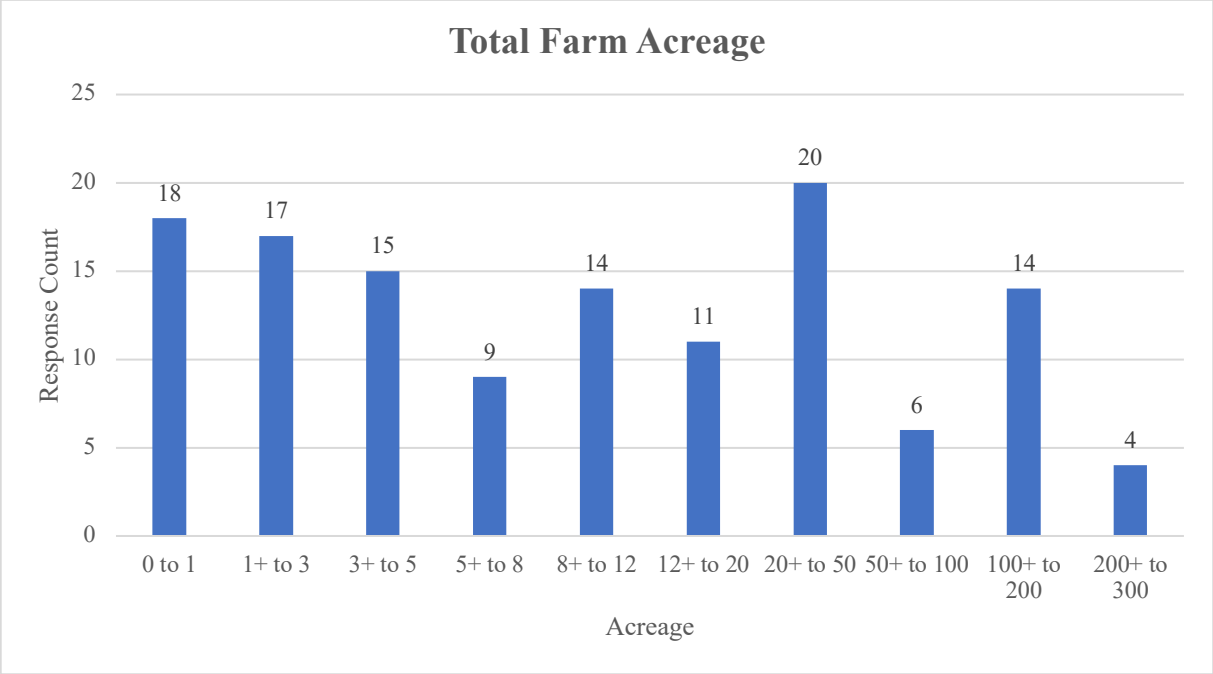
In this survey, 66% of respondents reported operating farms that are 20 acres or less and 39% of respondents, farms that were 5 acres or less (Figure 3.1). A full summary of crop acreages is provided in the appendix (Appendix F-1). These results are aligned with those of

Dennis (2015) who found 67% of new and beginning farmers in BC farm less than 20 acres and 84% of prospective farmers are seeking less than 20 acres. This too has important implications regarding the scale of production that is taught in training initiatives and curricula and may suggest focusing training on a small-scale. However, given the annual revenue and proportion of off-farm income indicated by respondents, scaling up to reach an efficient scale of production may also be an important topic of farmer training curricula. The idea of new farmers starting small and scaling up is supported by Dennis (2015) who found that while most, new alternative farmers in BC operate small farms, the vast majority (89%) aspired to expand their farming land base. This data may suggest that desired scale evolves as farmers become more established. However, given that most farmers in Dennis' study reported not seeking more than 20 acres, expanding their land base may mean *some* growth, but still within a fairly small scale.

These findings are reflective of the Expert Committee's discussion in the DACUM workshop around scale. The Committee was reluctant to limit alternative agriculture to just small-scale production due to their belief that it was often necessary to scale up to increase economic viability, even though they acknowledged that the majority of alternative farms operate on a small-scale. The Committee's dialogue around exploring various scales of production to address economic sustainability is an important conversation that should be included in training programs. Although alternative farms tend to operate at a small-scale (in particular when compared to industrial farms), there may be room for scaling up to increase profitability. Scaling up to reach production efficiency may look very different depending on the operation and may not even require increasing land-base, but rather focusing on increasing profits within a given land-base. Even though the DACUM Committee cited scaling up as often necessary to increase efficiencies, they all run profitable farms on relatively small acreages, the

largest being 60 acres and smallest at 2 acres. Thus, discussion around efficient scales of production remains very much within the small-scale nature of alternative farms. Further, the Expert Committee's ability to run profitable and successful farms on relatively small acreages suggests profitability within the alternative farming sub-sector hinges more on operational model than it does farm size.

Figure 3.1 Total Farm Acreage of Alternative Farmers Who Responded to the Validation Survey



The largest strata of respondents reported that they received agricultural training as a farm employee (31%; n=51/165) or through some other form (31%; n=51) (Table 3.16). Other respondents indicated that they had received no training at all (23%; n=38); volunteered on a farm (22%; n=37); or completed a farm apprenticeship or internship (21%; n=34). Thus, many respondents received their training informally. Notably, 23% of respondents reported receiving no training at all. These results seem to point to training occurring on individual farms, not

through any centralized resource or structured, purposeful programming. This conclusion is further supported by 17% (n=28) of respondents reporting receiving training through a farmer training program such as a farm school or formal practicum and 17% (n=28) receiving training through a post-secondary degree program.

These results are consistent with Dennis (2015), Knibb et al. (2012), and Niewolny & Lillard (2010), who all found the majority of new farmer training initiatives to take place in informal sites of education. The number of alternative farmers in BC receiving training informally through experience on operational farms, may point to the propensity of new alternative farmers to be from non-farming backgrounds (Knibb et al., 2012; Shute et al., 2011). This conclusion would be consistent with the findings of Laforge et al. (2018) who found BC to have the highest number of farmers from non-farming backgrounds. Further, they found that those respondents, who did not grow up on a farm, were more likely to engage in alternative practices. This notion may be substantiated by 10% of respondents reporting intergenerational training on a family farm and 17% through formal institutions. Alternatively, it may be that such training opportunities do not exist widely in BC, pointing to a need for increased training opportunities in the province. As Dennis (2015) states: "People entering agriculture from non-farming backgrounds have particular challenges with … agricultural training. Unlike those who enter agriculture through a farm family, … new farm entrants do not gain the hands-on training and skills from being raised on a farm, and instead seek it through volunteering, apprenticing, and/or employment. " (p. 51).

Given the challenges we face in the 21st century (climate change, natural resource depletion, biodiversity diminution, and political- economic uncertainty) and the increased number of farmers practicing sustainable agricultural practices required, it is imperative that

new-entrants are trained comprehensively and effectively in alternative agricultural methods. It does not seem prudent to leave such critical socio-economic need to arbitrary, ad hoc, or hit-or-miss training mechanisms. The high number of alternative farmers in BC receiving training informally points to a huge gap in training programs and supporting resources (Dennis, 2015; Knibb et al., 2012; & Niewolny & Lillard, 2010). Further, it is difficult to assess if these varied informal means of farmer training are sufficiently or appropriately preparing new farmers. One must make the assumption that training looks very different on each farm given the operational diversity seen across alternative farms in BC. Given the exceedingly high rate of farm failure, these informal training methods may be not be sufficiently preparing new farmers in alternative agriculture practices. These findings further corroborate the need for robust training programs that comprehensively train new-entrants in the knowledge and skills required to practice alternative agriculture. for sufficiently preparing new farmers in alternative agriculture.

Table 3.16 Agricultural Training Backgrounds of Alternative Farmers Who Responded to the Validation Survey

Agricultural Training	**Number of respondents**	**Percentage of respondents (%)**
Post-secondary degree in Agriculture or related field	23	13.94
Masters degree in Agriculture or related field	5	3.03
Farmer training program (e.g. season long certificate program such as farm school, formal practicum, etc.)	28	16.97
Farm apprenticeship or internship	34	20.61
Farm employee	51	30.91
Farm volunteer	37	22.42
Other, please specify	51	30.91
I have not completed any training and/or education	38	23.03
Total Count	165	-

Table 3.17 Other Agricultural Training Categories of Alternative Farmers Who Responded to the Validation Survey

Other (30.91%)	**Number of respondents**	**Percentage of respondents (%)**
Grew up on a farm	17	10.30
Diploma or certificate program in related field	12	7.27
Self-directed learning	5	3.03
Some course(s) or workshop(s)	5	3.03
On the job working or volunteering	6	3.64
Professional designation or training	4	2.42
Online learning	4	2.42
Total Count	165	-

3.6 Duty and Task Validation

The duty statements identified by the Expert Committee in the DACUM workshop were corroborated by survey respondents as central to the alternative farmer occupation. Eight of the fifteen duty statements were practiced by over 75% of respondents and fourteen were practiced by over 50% of respondents (Appendix F-2). Over 50% of respondents reported that they practice 14 of the 15 duty statements is especially impressive given the diversity of operational models that make up the sub-sector. These results suggest that the identified duty statements are integral to the alternative farming occupation and should be prioritized in training agendas. *Livestock operations*, was the only duty area that was selected by less than 50% of respondents (44%), likely indicative of fewer alternative farm operators engaging in livestock production. This should be taken into consideration when designing training curricula and programs. Various

distinct themes were identified in write-in responses, including seed stewardship, political activism, environmental advocacy, consulting, and research and development. However, most of these themes were encompassed in the task lists associated with various duty areas and did not warrant the addition of a separate duty statement.

Of 165 tasks, 111 (67%) received high level validation (75% agreement as important), 42 (25%) received medium level validation (50% agreement as important) and 12 (7%) received low level validation (less than 50% agreement as important) (Appendix F-3). Tasks that received the low level of validation, were rarely rated as 'not important' rather, they were most frequently rated as 'neutral' and less frequently as, 'not sure'. No tasks were rated 'not important' by more than 50% of respondents. The highest 'not important' rating a task received was 31%. On average, tasks with low level validation received a 'not important' rating of 13% and tasks with a medium level of validation received a 'not important' rating of 5% (Appendix F-3). This may indicate that rather than being irrelevant to the duty area, the tasks with lower levels of validation were simply not regarded as pertinent to all of the alternative farmers that responded to the survey. This may be reflective of the diversity of operational models reflected in the alternative farm operator occupation. Based on validation results and write-in responses, 49 new tasks were added (Appendix F-4) and 13 tasks were modified (Appendix F-5). No new duty areas were added to the DACUM chart.

Six duty statements had four or more task additions: Develop Farm Marketing and Sales Plan (7 task additions), Manage Livestock Operations (5 task additions), Manage Human Resources (5 task additions), Manage Harvest and Post-Harvest Handling of Crops (4 task additions), Manage Farm Finances (4 task additions), and Manage Farm Infrastructure (4 task additions). The large number of task additions to the duty 'Manage Livestock Operations' may

be explained by only a few members of the Expert Committee engaged in livestock operations. This resulted in livestock operations being a lesser point of discussion than vegetable crop production or business management duties, which more Committee members were involved in. The task additions to 'Manage Harvest and Post-Harvest Handling of Crops' were mainly focused on crop storage, delivery and creating efficient work flow. These tasks seem to simply have been missed by the Committee, which focused more on tasks specific to harvesting and processing crops. The task additions to 'Manage Human Resources' reflect the diversity of labour sources in the sub-sector. For example, one task addition related to managing volunteer and/or internship programs and another complying with foreign worker standards. Other task additions included creating a staff contingency plan, ensuring a living wage and providing adequate housing. The duty statement, 'Develop Marketing and Sales Plan' also had substantial task additions. These additions spoke to the diversity of sales outlets reflected in the sub-sector. For example, task additions included 'sell to wholesalers/retailers', 'sell via direct marketing outlets' and 'manage online sales platforms', each representing a unique sales strategy. Another task addition was 'plan and execute growth strategy', which was reflective of the discussion by the Expert Committee pertaining to scaling up but was not included as a task in this duty area. One addition to the 'Manage Farm Finances' duty was 'secure off-farm income', this addition makes sense given the survey respondent demographic results which showed many respondents with significant off-farm income. As this task was extremely important to many farmers in the province but less so to the Expert Committee the importance of ground-truthing the DACUM chart with a larger population of alternative farmers in the province is reinforced.

The number of task additions to the DACUM chart reflect both the complexity, vastness and diversity of the alternative farm operator occupation. It encompasses a wide range of

methods, enterprises and business models. Thus, many tasks are relevant to some farm businesses but not others. Therefore, including the wide-breadth of tasks associated with the occupation better captures the diversity of the sub-sector and increases the relevance of the DACUM chart. The opportunity to reach a large number of alternative farmers in the province through the online survey increased the robustness of the final DACUM chart and enhanced its representativeness of the realities of the sub-sector in the province. While the number of task additions underscores the importance of testing the Expert Committee's DACUM chart results on a larger population of occupational experts, it also highlights the importance of validating the DACUM chart in specific regional or operational contexts to ensure its relevance to each unique alternative agriculture operation or community.

3.7 Instructional Techniques Identified in the DACUM Workshop

The DACUM Committee discussed the effectiveness of various instructional techniques in training new alternative farmers. They drew on their own experience giving and receiving training to make recommendations through a free-form brainstorming session in the DACUM workshop. From this brainstorming session, the following five distinct instructional themes were identified: (1) on-farm experiential education; (2) theoretical education coupled with experiential education; (3) farmer-to-farmer mentorship; (4) long-term learning opportunities; and (5) continued professional development.

Theme 1: On-farm experiential education

Many of the instructional techniques identified by the DACUM Committee pertained to on-farm experiential learning. Experiential learning is the process of learning through experience, or 'learning by doing' (Kolb et al., 1999). More specifically, the Committee thought

that experiential learning within a working farm environment, was most effective for training new farmers. This concept is also known as work-based learning, which entails learning in a workplace environment through the completion of meaningful tasks (Jobs for the Future, n.d.). Various models are used to accomplish work-based learning including internships, apprenticeships, on-the-job training, co-ops, and/or transitional jobs (Jobs for the Future, n.d.). These models overlap with many of those suggested by the Expert Committee and those already employed in agricultural training programs: for example, farm-based practicums or farm school programs, apprenticeships or internships on production farms and/or employment experience.

Theme 2: Theoretical education coupled with experiential education

Theoretical learning was another theme presented by the Committee. This was reflected in the various types of knowledge deemed essential to their job. For example, plant biology and physiology; soil science; climatology; geography; business and financial management; food safety; integrated pest management; crop specific knowledge; entomology; environmental science; animal physiology, behaviour, and welfare; nutrient management; and seed saving were all types of knowledge identified by the Committee. Many of these topics are grounded in theory, suggesting that substantial theoretical knowledge is required of alternative farm operators.

New farmers and associated training programs have strong opinions on how theoretical knowledge should be delivered. Pedagogies that integrate theoretical and experiential learning to gain both knowledge and practice are preferred by both new farmer groups and training programs (Knibb et al., 2012; Niewolny & Lillard, 2010; Perez et al., 2010). In contrast, theoretical learning on its own (via traditional lecture-based modes of delivery without practical

application) is not a preferred way of learning by new farmers (Dennis, 2015; Laforge et al., 2018), nor is it popular amongst farmer training initiatives (Niewolny & Lillard, 2010; Schreiner et al., 2018). Thus, these results indicate that it is important to include substantial theoretical knowledge in alternative farming training programs; however, its integration with experiential learning is paramount for effective and comprehensive training. This makes immanent sense given agriculture, by definition, is an applied science. These results may point to a need for academically trained instructors involved in aspects of farmer training in order to comprehensively teach the large amount of theoretical knowledge associated with alternative agriculture.

Theme 3: Farmer-to farmer mentorship

Farmer-to-farmer mentorship was another prominent theme identified by the Committee. This was exemplified in the experiential learning models put forth (internships, apprenticeships, incubator programs, and employment opportunities), all of which represent forms of farmer-to-farmer mentorship. Other Committee recommendations that employed farmer-to-farmer mentorship included: farm tours, talking with other farmers and working side by side with experienced workers. The Committee's emphasis on farmer-to-farmer mentorship may be a result of their own experience giving and receiving training. It may also be due to much of alternative agricultural training currently occurring on individual farms (Niewolny & Lillard, 2010; Schreiner et al., 2018). These findings suggest that Committee members believe training should be connected with working farms and professional farmers, further emphasizing the concept of work-based learning in farmer training initiatives. Further, they emphasize farmers as valuable teachers who are particularly well-suited to engage with learners in experiential and

work-based learning models. This may mean that training programs that occur outside of a working farm environment (e.g., university programs, non-profits) should connect with working farms and farmers to provide the perspective of working practitioners. This could be done through field trips to working farms, workshops with farmers, hiring farmers as instructional staff, or housing programs within a working farm.

Theme 4: Long-term learning opportunities

The Committee emphasized the importance of long-term learning opportunities. They believed that new farmers require multiple seasons in a farm environment to adequately gain the skills and knowledge required of the profession. They contended that this allows learners to observe a farm over time, enhancing their understanding of cause and effect and the dynamics of the agroecosystem that unfold or manifest over time. It also provides opportunities to learn from mistakes. If training programs are to provide such long-term learning opportunities, a multi-step approach may be most effective. This may look like pairing initial 'introductory' programs with continued learning opportunities that are tailored to more advanced stages of learning. For example, introductory training programs may focus on basic skill and knowledge building over the first one to two farming seasons through structured programs such as farm schools, formal practicums and/or apprenticeships. Whereas, continued learning opportunities could take more of a work-based learning approach by offering experience via employment or apprenticeships, incubator farming programs, and/or internships on working farms. This concept of long-term learning opportunities that follow the stages of learner development is reflective of the new farmer typology put forth by Sheils and Descartes (2004). In their typology, they identify six continuous stages that new and beginning farmers go through prior to establishment. These

stages are split into ‘new farmer’ and ‘beginning farmer’ stages, beginning farmers being the more advanced stages of learning prior to establishment. Thus, training programs could target either ‘new farmers’ or ‘beginning farmers’ while offering ways to connect the programs together for learning to be continuous. This type of long-term, strategic training approach would likely be most effective to ensure comprehensive training. However, it will also likely require various stakeholders working together to effectively manifest such a model.

Theme 5: Continued Professional Development

The Committee also pointed to the need for continued professional development opportunities within training agendas. Continued professional development acknowledges the long-term nature associated with learning to farm successfully and the on-going need for training resources that support farmers of all experience levels. Suggested techniques included self-directed learning, online learning and opportunities for networking. For example, the Committee found learning through books or online resources valuable for acquiring specific knowledge. Online learning through webinars or workshops were also found to be valuable. Lastly, conferences and in-person workshops that facilitated networking opportunities with other farmers or members of the alternative agriculture community were found to be valuable. Extension services and programming could help to address the need for long-term, continuous training opportunities for all stages of farmers in the alternative agriculture sub-sector (dela Rosa et al., 2021). Thus, following the recommendations and plan put forth by dela Rosa et al. (2021) for the development of a province-wide organic extension service could provide the continual training and resources required by alternative farmers to support their long-term success.

Committee members found intentional goal setting to be an important way to guide professional development. Examples of this included setting goals for improvement, learning new methods, identifying long-term learning opportunities and setting personal and operational goals. Intentional goal setting can be useful for both new and established farmers learning trajectory. It can assist new farmers in identifying their goals and a pathway to achieve those goals and established farmers hone specific skills or achieve operational improvements. Thus, incorporating goal setting into training initiatives targeted at all farmer levels may be important in guiding learning trajectories.

3.8 Final DACUM Chart

The validated list of duties and tasks, task additions and task modifications were organized and arranged into the final DACUM chart. The duties and tasks were ordered in the chart according to their validation rating in the survey (from highest to lowest). Ordering the duties and tasks by degree of validation allows training programs to make decisions on their curricular emphasis based on validation rating. For example, programs may choose to prioritize or emphasize duties and tasks with higher degrees of validation in curricula. The final DACUM chart including all ordered duties and tasks is shown in Table 3.18. The DACUM chart includes 15 duty statements and 213 task statements. The delineation of duties and tasks in the DACUM chart clearly outlines the content that should comprise new farmer training as identified and verified by occupational experts. This is foundational to increasingly effective and regionally available training and increasing the number of well-trained new-entrants in the sub-sector.

Table 3.18 Final Developing a Curriculum (DACUM) chart that lists 15 duties (shown in bold) and their associated task statements for the occupation of alternative farm operator in British Columbia

A	**Manage Pests, Weeds and Diseases**
A-1	Assess pest pressure/damage
A-2	Identify pests (e.g. weeds, diseases, insects)
A-3	Determine pest control method
A-4	Manage weeds appropriately
A-6	Apply preventative measures for crops (e.g. crop rotation, cultural controls, on-farm biodiversity, habitat for beneficials
A-7	Implement approved pest control measures
A-8	Identify resources available for pest management
A-9	Manage biosecurity
A-10	Design and implement an integrated pest management (IPM) plan
A-11	Use pest control methods that minimize ecological detriment (e.g. beneficials, biological predators, organic products)
A-12	A-12 Follow health and safety protocols (e.g. proper personal protective equipment (PPE) and applicator trainings/certifications)
B	**Steward Soil Health**
B-1	Manage organic matter
B-2	Manage soil fertility (e.g. nutrients, pH, organic matter, C:N ratio)
B-3	Determine soil management based on soil properties (e.g. soil structure)
B-4	Manage soil water (e.g. availability, drainage, runoff)
B-5	Identify soil health resources
B-6	Manage composting systems
B-7	Conduct soil samples
B-8	Interpret soil tests
B-9	Create soil health plan
B-10	Increase soil organic matter (via cover cropping, crop rotation, nutrient cycling, livestock integration, etc.)
B-11	Manage soil to sequester carbon and reduce greenhouse gas (GHG) emissions
B-12	Produce and/or procure soil amendments
C	**Develop Farm and Marketing Sales Plan**
C-1	Manage customer relationships
C-2	Communicate with customers
C-3	Manage sales accounts
C-4	Develop brand
C-5	Handle cash, till, and point of sale (POS) software
C-6	Evaluate sales trends
C-7	Evaluate marketing needs
C-8	Maintain online/social media presence
C-9	Create marketing strategy (e.g. 4 P's: Produce, Place, Price, Promotion)
C-10	Develop marketing materials

C-11	Select appropriate marketing technology and tools for target demographic
C-12	Conduct market research
C-13	Sell at farmers markets
C-14	Manage online sales platforms
C-15	Sell to wholesalers/retailers
C-16	Sell via direct marketing outlets (e.g. CSA, farmgate, farmers markets)
C-17	Determine product prices
C-18	Establish sales networks plan for and execute growth strategy
C-19	Plan for and execute growth strategy
C-20	Move and store inventory efficiently
D	**Manage Harvest and Post-Harvest Handling of Crops**
D-1	Assess plant maturity for harvest
D-2	Clean harvest equipment and facilities
D-3	Perform quality control
D-4	Pack crops for distribution
D-5	Harvest crops to farm standards
D-6	Process crops to farm standards
D-7	Follow food safety standards
D-8	Prepare harvest tools and supplies
D-9	Record crop harvest
D-10	Project crop yield
D-11	Manage cullage
D-12	Create weekly harvest plans
D-13	Create standard operating procedures (SOP's) for harvest and post-harvest activities
D-14	Make value-added products
D-15	Manage post-harvest crop storage (e.g. refrigeration, curing, etc.)
D-16	Manage product delivery
D-17	Ensure efficient work flow
D-18	Design effective post-harvest processing area
E	**Manage Farm Business Administration**
E-1	Manage communications (e.g. emails)
E-2	Maintain record keeping systems
E-3	Set short and long-term goals
E-4	Procure tools, equipment and supplies
E-5	Secure access to land (e.g. purchase land, negotiate lease agreements)
E-6	Manage farm safety and security
E-7	Develop business plan
E-8	Obtain necessary licenses, permits and certifications
E-9	Order and track inventory
E-10	Maintain insurance policies
E-11	Establish business legal structure
E-12	Identify contractor needs (e.g. bookkeeper, electrician, etc.
E-13	Develop risk management plan
E-14	Create farm succession plan
E-15	Develop SOP's

E-16	Engage in government regulations and programs
F	**Manage Farm Finances**
F-1	Manage overall farm budget
F-2	Keep financial records
F-3	Pay taxes
F-4	Manage bookkeeping systems
F-5	Evaluate profitability of enterprises
F-6	Manage short and long-term debt
F-7	Source funds
F-8	Create, adapt and/or use enterprise budgets
F-9	Determine appropriate financing structure
F-10	Manage cash flow
F-11	Manage account payables/receivables
F-12	Secure off-farm income (if required)
G	**Operate Farm Equipment and Tools**
G-1	Operate equipment and tools safely and effectively
G-2	Select the right tool for the job
G-3	Repair tools and equipment
G-4	Troubleshoot mechanical problems
G-5	Sharpen tools
G-6	Operate farm vehicles
G-7	Determine short and long-term equipment and tool needs
G-8	Clean tools and equipment
G-9	Research equipment and tools
G-10	Inspect production equipment and facilities
G-11	Follow seasonal service protocol
G-12	Create standard operating procedures (SOP's) for tools & equipment
G-13	Train employees on equipment and machinery operation
G-14	Store equipment to maximize longevity
H	**Manage Farm Infrastructure**
H-1	Repair infrastructure
H-2	Construct infrastructure
H-3	Maintain infrastructure
H-4	Conduct basic carpentry
H-5	Evaluate infrastructure
H-6	Conduct basic plumbing
H-7	Conduct basic electrical
H-8	Establish preventative maintenance schedule
H-9	Demolish unnecessary infrastructure
H-10	Manage irrigation and drainage infrastructure
H-11	Determine new infrastructure needs
H-12	Research building codes and bylaws
H-13	Develop organizational systems for infrastructure spaces
I	**Manage Vegetable Crop Production**
I-1	Create crop plan (incl. seed order, planting schedule, crop selection)

I-2	Transplant crops (incl. seedlings, tubers)
I-3	Assess plant health
I-4	Direct sow crops
I-5	Apply appropriate soil fertility and amendments
I-6	Conduct crop specific maintenance plan (e.g. hilling, trellising, pruning)
I-7	Create and execute propagation plan
I-8	Record seeding and planting
I-9	Assess crop specific fertility requirements
I-10	Design and implement irrigation systems
I-11	Design and implement crop rotation plan
J	**Manage Water Resources**
J-1	Design and implement irrigation system
J-2	Assess irrigation needs (e.g. pressure, flow, volume required)
J-3	Conserve water resources (e.g. water sources, riparian areas, waterways, reduce waste)
J-4	Manage drainage
J-5	Assess drainage needs
J-6	Monitor and maintain water quality
J-7	Adhere to local regulations
J-8	Create water supply chain
J-9	Execute water supply chain
J-10	Maintain irrigation infrastructure
J-11	Plan and execute irrigation schedule
J-12	Prioritize use of renewable water resources
K	**Engage in Community**
K-1	Establish relationships with other farmers, businesses and other organizations
K-2	Promote sustainable local farming and food security
K-3	Patronize local businesses
K-4	Maintain friendly relationship with neighbours
K-5	Conduct education and outreach activities
K-6	Engage in community events and farm tours (e.g. host, attend, participate in)
K-7	Acknowledge and engage with local First Nation communities
K-8	Engage with government (e.g. lobbying, policy, programs)
L	**Manage Human Resources**
L-1	Delegate tasks to staff
L-2	Train employees (incl. orientation)
L-3	Determine staffing needs
L-4	Oversee staff work
L-5	Align staff skills with farm needs
L-6	Establish employee health & safety protocol
L-7	Resolve employee issues/conflict
L-8	Recruit job applicants
L-9	Solicit staff feedback
L-10	Manage WorkSafe BC requirements
L-11	Manage payroll and accounting

L-12	Evaluate staff performance
L-13	Conduct interviews
L-14	Establish employment contracts
L-15	Establish communications protocol for staff
L-16	Create job descriptions (incl. owners, managers, seasonal staff)
L-17	Facilitate staff goal setting
L-18	Research worker grants and subsidies
L-19	Establish HR/staffing policies (e.g. employee handbook)
L-20	Facilitate professional development for workers
L-21	Manage volunteer/internship program(s)
L-22	Provide a positive work environment for staff (e.g. living wage, adequate housing, group morale etc.)
L-23	Create a staff contingency plan
L-24	Comply with foreign worker standards
M	**Manage Perennial Crop Production**
M-1	Design perennial crop plan (e.g. select root stock, identify crops, succession planting, design systems)
M-2	Create and execute irrigation plan
M-3	Prune crops (for both disease and canopy management)
M-4	Assess fruit maturation
M-5	Manage crop load
M-6	Renew/renovate beds
M-7	Manage understory, floor and non-production areas
M-8	Develop and maintain crop supports (e.g. trellises)
M-9	Propagate crops (e.g. grafting, budding)
M-10	Establish and maintain hedgerow
M-11	Develop and adhere to spray schedule
M-12	Create and execute drainage plan
M-13	Design and manage intercropping systems
N	**Pursue Professional Development**
N-1	Learn from experience
N-2	Observe farm daily
N-3	Visit other farms
N-4	Read agricultural literature
N-5	Keep posted on current events and trends
N-6	Attend classes, conferences and workshops
N-7	Establish relationship with local institutions and organizations
N-8	Engage in mentorship opportunities
N-9	Keep a farm journal
N-10	Engage in online resources (e.g. tutorials, workshops, publications)
N-11	Participate in industry associations and/or organizations
O	**Manage Livestock Operations**
O-1	Monitor livestock health
O-2	Obtain feed and supplements
O-3	Assess animal welfare and ethics

O-4	Identify animal health and welfare resources/requirements
O-5	Create and execute daily chore schedule
O-6	Manage pasture rotations
O-7	Cull sick or injured animals
O-8	Create livestock production plan
O-9	Create and execute slaughter plan
O-10	Create and execute waste resource plan (e.g. manure, carcasses, offal, etc.)
O-11	Conduct further processing of products
O-12	Establish flock or animal ID system
O-13	Protect livestock from predators
O-14	Grow supplemental livestock feed (e.g. pasture, hay, grain, etc.)
O-15	Source stock
O-16	Breed livestock
O-17	Manage livestock infrastructure (e.g. housing, fencing, watering, feeding systems)

3.9 Conclusions

Fifteen duties and 213 tasks were identified and confirmed as integral to the alternative farm operator occupation in BC and thus included in the final DACUM chart. The identified duty statements pertained to themes of crop and livestock production, business planning, technical skills, resource management and social initiatives. The associated task lists comprehensively described each duty statement in terms of smaller units of work, setting the groundwork for further curricula development. The Expert Committee also identified various skills, knowledge, attitudes and behaviours required to effectively perform the duties and tasks of their occupation, contributing to the information that can be used for further curricula and pedagogy development. The validation survey corroborated that identified by the Expert Committee and revealed new task additions and modifications pertaining to numerous duty areas. This increased the relevance of the final DACUM chart to broader range of alternative farm operators in BC by including those tasks important to an extensive breadth of occupational models within the sub-sector. The extensive list of duties and tasks included in the DACUM chart, and the associated list of skills, knowledge, attitudes and behaviours provide immense insight into the occupation of alternative

farm operators in the province and lays the foundation for further curricula and pedagogy development that is grounded in occupational realities.

Various demographic and occupational data were collected in the validation survey providing a deepened understanding of the alternative farmer population in the province. Alternative farmers in BC appear to have a larger young contingent (under the age 35), less farmers approaching retirement age (over the age 55), be majority female, majority white and most have some form of higher education. Most respondents operate private businesses, produce vegetable crops and/or perennial crops, operate on a small-scale when measured both in revenue (less than $250k annually) and acreage (less than 20 acres), and rely on significant amounts of off-farm income. Despite these trends, a diversity of other operational models were revealed by survey respondents including farms with larger acreages, greater revenue, limited off-farm income and a diversity of enterprises and operational models. Thus, the delivery of the sub-sector in the province seemed to be captured in the survey responses. The majority of survey respondents received their agricultural training informally via on-farm employment, volunteering, or through an apprenticeship or internship. Few received training through formal purveyors of agriculture education such as universities or colleges and few through farm schools or formal practicums. The number of alternative farmers that reported informal types of training further emphasizes the importance of developing the high-quality training programs and associated curricula and pedagogies.

The Expert Committee identified and prioritized various instructional techniques aimed at training new alternative farmers. The Committee recommended on-farm experiential education be employed by incorporating experiential learning and work-based learning models into training programs. Recommendations for implementation included farm-based practicums or farm school

programs, apprenticeships or internships on production farms and/or employment experience. Theoretical education coupled with experiential education was also recommended. The Committee acknowledged the extensive theoretical knowledge required of their occupation and believed it is most effectively taught when integrated with experiential learning to enhance learners' connections between the field and classroom. The committee also emphasized the importance of utilizing farmers as teachers via forms of farmer-to-farmer mentorship. Examples included internships and apprenticeships, incubator programs, employment opportunities, farm tours, kitchen table meetings and working alongside experienced workers. The Committee also identified the need for long-term learning opportunities within farmer training. They emphasized that it takes several years to learn how to farm and thus it is important to provide continuous learning opportunities for new farmers to comprehensively hone their knowledge and skills. Lastly, the Committee expressed the need for continued professional development opportunities for all stages of new and established farmers. This concept also addresses the long-term nature of learning how to farm as well as the continued scientific and technological advancement in the industry requiring associated training, and thus the need even for continued learning opportunities for established farmers. Recommended modes of delivery for professional development activities included self-directed learning and goal setting, online learning, opportunities for networking, online resources, webinars, workshops and conferences. Many of these types of professional development and on-going learning opportunities are facilitated by agriculture extension services; something rather piecemeal in BC.

The final DACUM chart, coupled with the described instructional techniques, comprehensively describes the occupation of alternative farmer in BC and provides a framework for training new-entrants in the associated duties and tasks. Thus, the results of this study provide

the first steps towards comprehensive and effective curricula and pedagogy development for new farmer training programs in alternative agriculture in the province.

4 General Conclusions

4.1 Summary of Results

This thesis identified the essential duties and tasks associated with the occupation of alternative farm operator in BC. The final DACUM chart outlines 15 duties and 213 tasks that comprehensively describe the occupation of alternative farm operator in the province. The various duties and tasks pertain to themes of crop and livestock production, business planning, technical skills, resource management and social initiatives, suggesting that these themes be central to alternative farmer training agendas. The corroboration and further development of the DACUM chart by 174 alternative farmers from across the province, increases the robustness and occupational representation of the chart and its relevance to the sub-sector. The extensiveness (number of duties and tasks) of the chart increases its adaptability to various operational or regional contexts as it encompasses a large breadth of operational models and enterprises.

This project also demonstrated how the identified duties and tasks should be best learned and taught to prepare new farmers. The Expert Committee identified five instructional techniques to effectively teach the duties and tasks including: (1) on-farm experiential education; (2) theoretical education coupled with experiential education; (3) farmer-to-farmer mentorship; (4) long-term learning opportunities; and (5) continued professional development. Various specific pedagogical approaches were recommended within these instructional themes by the Expert Committee that provide a useful guide for curricula and program delivery. These instructional techniques are corroborated by findings in the literature outlining new farmer learning preferences and best practices (Dennis, 2015; Knibb et al., 2012; Laforge et al., 2018; Niewolny & Lillard, 2010; Perez et al., 2010), thus, providing the basis for further pedagogical development to effectively teach the knowledge and skills required of alternative farmers.

Lastly, this project aimed to develop a curricular and pedagogical resource to guide the development of agricultural education programs that train new alternative farmers in the province. The DACUM chart outlines an extensive and corroborated list of duties and tasks that clearly and completely outlines the requirements of the alternative farm operator occupation in the province. This chart provides a clear and concise guide for curricula and lesson plan development. The Expert Committee identified five instructional techniques to most effectively train new-entrants. These instructional techniques outline effective pedagogies (experiential and work-based learning, integration of theory and knowledge, long-term learning, etc.) and specific modes of delivery (farm schools, incubator plots, farm tours, apprenticeship/internships, etc.) to teach the identified duties and tasks. Thus, the final DACUM chart and the described instructional techniques provide a clear framework for curricular and program development that is unequivocally grounded in the perspectives and experiences of BC's alternative farmer demographic. These results provide clear curricular and pedagogical direction to most appropriately and comprehensively train new-entrants to enable and advance an alternative agriculture sector.

4.2 Strengths and Contributions of Research

Few studies have sought to exhaustively identify the curricular content and pedagogical approaches that should comprise alternative farmer training programs. Existing studies have either focused on identifying and describing farmer training initiatives (Niewolny & Lillard, 2010; Schreiner et al., 2018) or conveying new farmer learning preferences and training gaps (Dennis, 2015; Knibb et al., 2012; Laforge et al., 2018; Perez et al., 2010; Sheils & Descartes, 2004). The results of this study establish a comprehensive curricular and pedagogical framework for training new alternative farmers in BC and likely elsewhere. Two partners on this project,

KPU-Institute for Sustainable Food Systems Farm Schools and the Center for Sustainable Food Systems at the UBC Farm, will use these results to improve the curricular content and pedagogy of their programs. The DACUM chart and accompanying technical report will be made available as open-source materials on the ISFS website, to support other farmer training initiatives, setting the groundwork for adequate training in the province and elsewhere.

4.3 Study Limitations and Future Work

4.3.1 Study Limitations

This study was focused within BC and thus is limited to the perspectives of alternative farmers within the province. These results may or may not be fully transferable to other regions in Canada or North America. Antecedent validation of the DACUM chart may be required if results are to be used in regions outside of BC.

The DACUM workshop was limited to a one-day session rather than the two days suggested in the DACUM handbook (Norton, 1992) due to the time constraints of the Expert Committee. The modifications made to the DACUM process to accommodate this schedule may have impacted the Committee's ability to fully describe their occupation in terms of duties and tasks. A one-day workshop also reduced the amount of time the Committee was able to commit to identifying instructional techniques, attitudes, knowledge and skills. However, the number of alternative farmers that responded to the validation survey helped to mitigate potential impact of the abbreviated DACUM session. In reaching such a large number of survey respondents the accuracy of the DACUM chart was tested and gaps identified via a larger population assessment.

The number of duties and tasks in the DACUM chart resulted in a very long validation survey. In order to ensure a high response rate, not all validation questions normally included in the DACUM survey were asked. We focused on validating the *importance* of each task as well

as identifying any missing tasks, but did not ask questions pertaining to *difficulty* or *frequency* of tasks. Steps to ascertain the difficulty and frequency of tasks, to further inform curricula should be taken for program development.

4.3.2 Future Research

The results outlined in this thesis provide the initial framework for further curricula and pedagogy development. Next steps in curricula development will be to describe each task in terms of steps (single units of work). Steps will thoroughly describe each task and provide a clear delineation of the skills and knowledge required to complete it. For example, the task 'determine pest control method' may be broken down into the following steps: (1) determine severity of pest outbreak; (2) determine available and approved pest control measures; and (3) determine appropriate control based on severity and availability. Lesson plans that incorporate all steps associated with each task in the DACUM chart would then be developed. The emphasis given to individual duties and tasks in the curricula will be guided by the results of the validation survey; those tasks with higher degrees of validation (importance) should have greater curricular emphasis. Next steps in pedagogy development will be to determine the most appropriate teaching approach for each task comprising the DACUM chart. The first steps will be to identify if a task should be taught in the field, classroom or both. This will provide the basis for further lesson plan development using the recommended pedagogical approaches.

Research focusing on long-term, continuous farmer training models would be of great value. Long-term learning models that progress through the stages of the new and beginning farmer typology (Sheils & Descartes, 2004) should be explored in terms of what models exist, and are they effective and practical. Inquiry as to which stakeholders should be involved to

create such a training model should be prioritized. Identifying key stakeholders and outlining a model for long-term, continuous training would provide a necessary step forward in ensuring adequate and comprehensive training programs and increasing the output of new alternative farmers.

Further research and policy recommendations for how to reduce barriers including: (1) access to land; (2) access to capital; (3) high start-up costs and (4) low profitability is needed to achieve economic and policy reform. This is essential to the transition to a viable alternative agricultural system.

The demographics of alternative farmer populations should be reflected in curricula and pedagogy development and program delivery. Examples include the high degree of female representation, high rates of higher education and a larger young contingent (under the age of 35).

The results of this research, primarily the DACUM chart, should be adapted regionally to support and/or facilitate the development of training programs across Canada and North America. This would entail validating the DACUM chart results from this study regionally to ensure it is representative of its specific agricultural and occupational contexts. This could be done through a one-day DACUM workshop with occupational experts or through a regional survey.

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Appendices

Appendix A – Definitions

Appendix A-1: Preliminary Alternative Farm Operator Definition

Farm operators are defined as: those persons responsible for day-to-day decision making and execution of operations on the farm.

Alternative farmer/farming is defined as:
Alternative farming encompasses agricultural practices *alternative* to those of the global/industrial food system in both their production methods and marketing channels. Alternative agriculture includes farming systems such as organic farming, agroecology, biodynamic, regenerative agriculture, and sustainable agriculture.

They have a tendency to employ:

1. Ecological growing practices to minimize adverse environmental effects. These include, but are not limited to crop rotations, cover cropping, sustainable soil management, crop diversity, minimization of synthetic chemical use, etc.
2. Direct-marketing channels such as sales through farmers markets, CSAs, farm-gate, restaurants, food hubs, and/or local groceries.
3. Small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies.

**Industrial agriculture* is a form of modern farming that refers to the industrialized production of livestock, poultry, fish, and crops. The methods of industrial agriculture are technoscientific, economic, and political. They include innovation in agricultural machinery and farming methods, genetic technology, techniques for achieving economies of scale in production, the creation of new markets for consumption, the application of patent protection to genetic information, and global trade. (New World Encyclopedia)

Appendix A-2: Integrated Agricultural Production Systems

"Integrated agricultural production systems are agricultural systems with multiple enterprises that interact in space and/or time and the interactions result in a synergistic resource transfer among enterprises" (Hendrickson et al., 2008)

Appendix B – DACUM Committee Emails and Consent Form

Appendix B-1: Initial Contact Email to DACUM Expert Committee

I am emailing you on behalf of the Institute for Sustainable Food Systems at Kwantlen Polytechnic University and the Center for Sustainable Food Systems at the UBC Farm. I obtained your name and contact information from Véronik Campbell at the UBC Farm, and am calling to inquire about your potential to participate in a research project we are conducting *to develop instructional materials for existing agricultural education programs that train new alternative farmers in BC, such as the Tsawwassen Farm School, the Richmond Farm School and the Practicum in Sustainable at the UBC Farm, as well as support the development of new programs across the province and country.*

Research Process & Participant Involvement
The goal of this research is to develop comprehensive instructional materials to use in programs intending to train new alternative farmers. To do this we will engage a small group of 'alternative' farmer operators in BC (six to ten) in a facilitated workshop during which the selected farmers will identify the key skills, knowledge, and instructional strategies associated with the occupation of alternative farming. This workshop will take place in mid-January over the span of one, eight-hour day in a conference room at Kwantlen Polytechnic University, Richmond campus. Refreshments and lunch will be provided. There will be some, but minimal, work before the workshop requested of participants; including providing feedback on materials to be used in the workshop (requiring an estimated one to two hours of time). Participants will be afforded a $400 honorarium for their time and we will fully reimburse all reasonable direct travel/participation costs.

Farm operators are defined as: those persons responsible for the day-to-day management decisions made in the operation of an agricultural operation.

Alternative farmers/farming is defined as:
Alternative agricultural practices differ from industrial agriculture in their production methods and marketing channels. Alternative agriculture includes farming systems such as organic farming, agroecology, biodynamic, and regenerative and sustainable agriculture.

They have a tendency to employ:

1. Ecological growing practices to minimize adverse environmental effects. These include, but are not limited to crop rotations, cover cropping, sustainable soil management, crop diversity, minimization of synthetic chemical use, etc.
2. Direct-marketing channels such as sales through farmers markets, CSAs, farm-gate, restaurants, food hubs, and/or local groceries.
3. Small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies.

Benefits
Participants will contribute to the development of instructional materials used to train new alternative farmers in BC. This will enhance effective training of new farmers as competent and successful future farm owners, managers and employees in the alternative agricultural sector in BC. Further benefits of participating in this study include: influence the training and development of new farmers in BC, fostering community connections amongst the alternative agriculture sector in the province, and contributing to the start-up and success of farmer training programs in the province.

Voluntary Participation: Participating in this research is entirely voluntary. You have the right to withdraw from the research process at any time without providing any justification and without consequence. Declining to participate in this research will not affect your personal or professional reputation in any way.

Confidentiality: Participants that would like to be acknowledged by name for their contributions to this study will be acknowledged in subsequent study publications as appropriate. If participants prefer not to be identified in association with this study, researchers will ensure confidentiality measures are taken. These include: excluding the participant's name or any other identifying factors in interview transcripts, research documents, and publicized materials.

Electronic copies of transcripts and all other documents will be kept in the password protected, encrypted local hard drives of the research team. All hard copies of documents and recordings will be kept in a locked filing cabinet in the office of the principle investigator (Dr. Maja Krzic) and the graduate student researcher (Sarah Clements).

Do you have any questions about the project?
Please email the graduate student researcher, Sarah Clements.

Would you like to participate?
If yes, please reply to Sarah Clements stating your intent to participate. If you agree to participate in the study, I will email you the consent form detailing the research purpose, procedures, compensation, and confidentiality agreement for you to review and sign. Once the consent form is signed we will be in further contact about the coming research activities.

Project Partners:
Principal Investigator:
Dr. Kent Mullinix, PhD, Director, Institute for Sustainable Food Systems, Kwantlen Polytechnic University

Graduate Student Investigator:
Sarah Clements, MSc Candidate, Integrated Studies in Land and Food Systems, University of British Columbia; Research and Extension Associate, Institute for Sustainable Food Systems, Kwantlen Polytechnic University

Co-Investigators:
Dr. Maja Krzic, PhD, Associate Professor, Applied Biology/Forest and Conservation Studies University of British Columbia

Veronik Campbell, Manager, Community-Engaged Education & Partnerships, Center for Sustainable Food Systems at UBC Farm

Appendix B-2 Letter of Informed Consent for DACUM Workshop

Letter of Informed Consent—DACUM Workshop

Title of Research Project: Training New BC Farmers in Alternative Agricultural Practices: Identifying Critical Knowledge, Skills, and Effective Instructional Techniques.

Principal Investigator:
Dr. Maja Krzic, PhD, Associate Professor, Applied Biology/Forest and Conservation Studies University of British Columbia

Graduate Student Investigator:
Sarah Clements, MSc Candidate, Integrated Studies in Land and Food Systems, University of British Columbia; Research and Extension Associate, Institute for Sustainable Food Systems, Kwantlen Polytechnic University

Co-Investigators:
Dr. Kent Mullinix, PhD, Director, Institute for Sustainable Food Systems, Kwantlen Polytechnic University

Veronik Campbell, Manager, Community-Engaged Education & Partnerships, Center for Sustainable Food Systems at UBC Farm

You have been invited to participate in a facilitated workshop to engage in discussion around training new and aspiring farmers in BC in alternative agricultural methods. The project is a collaboration between the Institute for Sustainable Food Systems (ISFS) at Kwantlen Polytechnic University (KPU) and the Center for Sustainable Food Systems (CSFS) at the University of British Columbia (UBC).

The goal of the project is to develop instructional materials for agricultural education programs that train new alternative farmers such as the Tsawwassen Farm School, Richmond Farm School,

the Practicum in Sustainable Agriculture at the UBC Farm, as well as in the development of ISFS extension education programming. The information collected in this research process will help to effectively train and support new and practicing alternative farmers in BC, thus contributing to the growth of the alternative agricultural sector in BC.

Voluntary Participation
Your participation in this study is entirely voluntary. You have the right to withdraw from the workshop at any time and for any reason without consequence. Participants that choose to withdraw at any point during the workshop will be compensated in full. If you choose to withdraw fully, all data that you have provided will be immediately destroyed.

Purpose
The purpose of this study is to understand the perspective of alternative farmer operators in BC regarding how new alternative farmers in BC should be trained.

Farm operators are defined as: those persons responsible for the day-to-day management decisions made in the operation of an agricultural operation.

Alternative farmers/farming is defined as:
Alternative agricultural practices differ from industrial agriculture in their production methods and marketing channels. Alternative agriculture includes farming systems such as organic farming, agroecology, biodynamic, and regenerative and sustainable agriculture.

They have a tendency to employ:

1. Ecological growing practices to minimize adverse environmental effects. These include, but are not limited to crop rotations, cover cropping, sustainable soil management, crop diversity, minimization of synthetic chemical use, etc.
2. Direct-marketing channels such as sales through farmers markets, CSAs, farm-gate, restaurants, food hubs, and/or local groceries.
3. Small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies.

Specifically, this study seeks to identify the critical knowledge, skills, and instructional techniques that should be included in agricultural education/extension programming that intends train/support new alternative farmers. The information gathered in this study will be used to create instructional materials for agricultural education and extension programming that train new alternative farmers.

Study Procedures
Your involvement will entail full participation in a facilitated workshop that will take place in mid-January of 2019, over the span of one, eight-hour day as well as minimal email contact and pre-workshop prep (estimated between one and two hours). The workshop will take place in a conference room at the KPU-Richmond campus where lunch and refreshments will be provided. Participants that agree to partake will be asked to attend the entire session. The workshop will

require full participation in a facilitated and collaborative brainstorming process. Due to the high level of participation required in this workshop, we are seeking participants with good communication skills, who work collaboratively, and are passionate about alternative agriculture.

Project Outcomes
The data collected from the one-day workshop will be used to create an online questionnaire that will be disseminated to alternative farmers across BC for validation. Subsequent data from the workshop and questionnaire will then be used to create an instructional document that will be published for use in new alternative farmer training programs. Study results will be published in journal articles, project summaries, plain-language community briefs, and in a MSc thesis dissertation. The instructional document will be made open-source to support the development of new alternative farmer training programs in BC and across Canada, as well as aid existing programs in enhancing their teaching programs and methods.

Potential Benefits:
Participants will contribute to the development of instructional materials used to train new alternative farmers in BC. This will enhance effective training of new farmers as competent and successful future farm owners, managers and employees in the alternative agricultural sector in BC. Further benefits of participating in this study include: influence the training and development of new farmers in BC, fostering community connections amongst the alternative agriculture sector in the province, and contributing to the start-up and success of farmer training programs in the province.

Remuneration/Compensation
Participants will be compensated for their time and travel with a $400 stipend plus coverage of additional travel expenses.

Potential Risks
Very minimal risk is anticipated from participating in this project. There is very minimal potential negative economic, social, or emotional risk associated with your participation. There is no risk to your personal or professional reputation if you refuse to participate. In the unlikely event of research related harm, you do not waive your right to legal recourse by consenting to participate.

Confidentiality:
If you wish to be acknowledged by name for your contributions to this study in subsequent publications, please indicate in the box below. If you prefer not to be identified in association with this study, researchers will ensure confidentiality measures are taken. These include: excluding your name or any other identifying factors in interview transcripts and publicized materials.

Participant confidentiality cannot be guaranteed as the research team cannot control what other participants do with the information discussed during the workshop. However, we encourage all participants to refrain from disclosing the contents of the discussion outside of the workshop in order to respect participant confidentiality.

Electronic copies of transcripts and all other documents will be kept in password protected, encrypted local hard drives of the research team. All hard copies of documents will be kept in a locked filing cabinet in the office of the graduate student researcher at the Kwantlen Polytechnic University Richmond campus and the office of the PI at the UBC, Vancouver campus. Data will be stored for no longer than five years. After five years, all project data will be destroyed.

I would like to be acknowledged by name in study publications:

Yes
€
No
€

Dissemination of Results:
The data obtained from this study will be made open access. This means that the study data will be made available to the public within 12 months of publication. All data and associated research publications will be hosted on the partnering organizations (ISFS and CSFS) webpages as well as on UBC's cIRcle digital repository. All participant identifiers associated with the data will be removed prior to making data open access. Only those participants that have agreed to be identified on published materials will be acknowledged by name.

If you would like to be contacted by email with the study results indicate so here. Please provide us with an email address in which to contact you with study results.

☐ I would like to be contacted with study results

Participant contact email: _____

☐ I prefer not to be contacted with study results

Contact for information about the study
If you have any questions or would like further information with regard to this study, please contact Sarah Clements.

Contact for concerns or complaints about the study
If you have any concerns or complaints about your rights as a research participant, and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Ethics at xxx-xxx-xxxx or if long distance e-mail to xxxx@ors.ubc.ca or call toll free x-xxx-xxx-xxxx; or the Kwantlen Office of Research and Scholarship at xxx-xxx-xxxx. All other concerns or complaints may be directed to the Principle Investigator, Dr. Kent Mullinix.

Alternatives to Workshop Participation:
If you are unable to participate in the full day workshop but would like to contribute to the study, we will be soliciting participation for an online questionnaire. The questionnaire will be distributed between February and May 2020 to alternative farmers in BC in order to validate the results of the workshop. It will take approximately 15 minutes to complete.

☐ I would like to be contacted for participation in the online questionnaire

☐ I would not like to contacted for participation in the online questionnaire

Consent
Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time without consequence. Your signature below indicates that you have received a copy of this consent form for your own records and that you consent to participate in this study.

Printed Name of Participant: _____

_____ _____
Signature of Participant Date
OR

€ Check for Verbal consent

Please provide your contact details if you are interested in receiving the results of this study:

Address:

Phone #:

Alternative Phone #:

Email:

Appendix B-3 DACUM Participant Follow-up Email

Hello _____,

Thank you for your willingness to participate in the study—*Training New BC Farmers in Alternative Agricultural Practices: Identifying Critical Knowledge, Skills, and Effective Instructional Techniques.* As a participant, you are asked to attend and engage in a one-day workshop that will take place on January __ from 9am to 5pm at Kwantlen Polytechnic University (KPU), Richmond Campus. Located at 8771 Lansdowne Rd, Richmond, BC. All participants are asked to commit to the full day workshop. If this is not possible for you, please let me know as soon as possible. Your participation in the workshop will be compensated with a $400 stipend and reimbursement of associated travel costs.

The workshop will include a cohort of six to ten alternative BC farmers, a facilitator (myself), and two research assistants. As the workshop facilitator, I will lead the Committee of farmers through a brainstorming process that will ask you to collaboratively identify the essential skills and knowledge associated with your work as an alternative farmer. Once we have a comprehensive list of skills and knowledge, we will ask you how you think these skills and knowledge should best be taught in order to effectively train new farmers. This information will provide an instructional framework for the development of extension educational materials and programming to train new alternative farmers in BC.

Due to the nature of this research process, it is essential that all participants agree to the vocational definition of *alternative farm operator*.

Farm operators are defined as: those persons responsible for the day-to-day management decisions made in the operation of an agricultural operation.
Alternative farmer/farming is defined as: alternative agricultural practices differ from industrial agriculture in their production methods and marketing channels. Alternative agriculture includes farming systems such as organic farming, agroecology, biodynamic, regenerative agriculture, and sustainable agriculture.
They have a tendency to employ:

1. Ecological growing practices to minimize adverse environmental effects. These include, but are not limited to crop rotations, cover cropping, sustainable soil management, crop diversity, minimization of synthetic chemical use, etc.
2. Direct-marketing channels such as sales through farmers markets, CSAs, farm-gate, restaurants, food hubs, and/or local groceries.
3. Small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies.

Please find attached an informed consent document. You are required to sign and return before participating in this study. Signed consent documents can be sent via e-mail to the graduate student researcher, Sarah Clements or by post to the address Institute for Sustainable Food Systems, Kwantlen Polytechnic University, 12666 72nd Ave, Surrey, BC V3W 2M8; ATTN: Sarah Clements. We ask you to return the signed consent document by December ____, so we can confirm your participation. Your participation in this study is entirely voluntary and you have the right to withdraw at any point without consequence. By signing the consent form, you do not waive your right to legal recourse in the unlikely event of research related harm.

Upon receiving your signed consent document, we will be sending you a list of major responsibilities associated with the alternative farmer vocation. We ask you to review this document and offer any feedback in terms of additions, deletions, and/or revisions to the list. We will be working with this list of core responsibilities throughout the one-day workshop.

Thank you very much for your willingness to contribute to the successful execution of this study. Your expertise and participation is highly valued and will contribute to the development and delivery of effective extension education programming for new BC farmers in alternative agricultural practices. We will send you a reminder email two weeks before the workshop with details of the workshop schedule. We will also send you a reminder a few days before the workshop. If you have any questions, feel free to email or call me at the email and/or phone number provided below.

Sincerely,
Sarah Clements

Appendix B-4 DACUM Participant Two-Week Reminder Email

Hello *participant name,*

This is a reminder that we are two weeks out from the *alternative farmer training*, one-day intensive workshop! The workshop will take place on January _ from 9am to 5pm at Kwantlen Polytechnic University (KPU), Richmond Campus in room number ___. Located at 8771 Lansdowne Rd, Richmond, BC. There is ample parking on campus, we will provide a parking permit for you. You will have a one-hour break between 12 and 1pm, during which we will provide lunch. All participants are asked to attend the full day workshop, if this is not possible for you, please let me know as soon as possible. Your participation in the workshop will be compensated with a $400 stipend and coverage of travel costs. Your participation is entirely voluntary and you have the right to withdraw from the study at any time without consequence. Participants that choose to withdraw at any point during the workshop will be compensated in full. Please send the lead researcher, Sarah Clements, a complete itemization of your travel costs and receipts so that we can reimburse you.

If you have not yet sent your feedback on the list of core responsibilities (duties and tasks) previously sent to you, please do so now. If we do not receive feedback, we will assume that you agree with the list of core responsibilities. We will further confirm this list of core responsibilities during the workshop in which there will be space for further feedback and revisions from participants. However, we have a lot to accomplish during the session and hope to hasten this part of the process by getting your feedback on this list prior the workshop.

Thanks for your willingness to partake in this study, your participation is highly valued and will significantly contribute to the training of new BC farmers using alternative agricultural practices! If you have any questions, feel free to email or call me at the email and/or phone number provided below.

Sincerely,
Sarah Clements

Appendix B-5 DACUM Participant Week of Reminder Email

Hello *participant name,*

This is a reminder that we are just a few days out from the *alternative farmer training*, one-day intensive workshop! The workshop will take place on January _ from 9am to 5pm at Kwantlen Polytechnic University (KPU), Richmond Campus in room number ___. Located at 8771 Lansdowne Rd, Richmond, BC. There is ample parking on campus, we will provide a parking permit for you. You will have a one-hour break between 12 and 1pm, during which we will provide lunch. All participants are asked to attend the full day workshop, if this is not possible for you, please let me know as soon as possible. Your participation in the workshop will be compensated with a $400 stipend and coverage of travel costs. Your participation is entirely voluntary and you have the right to withdraw from the study at any time without consequence. Participants that choose to withdraw at any point during the workshop will be compensated in full. Please send the lead researcher, Sarah Clements, a complete itemization of your travel costs and receipts so that we can reimburse you.

If you have not yet sent your feedback on the list of core responsibilities (duties and tasks) previously sent to you, please do so now. If we do not receive feedback, we will assume that you agree with the list of core responsibilities. We will further confirm this list of core responsibilities during the workshop in which there will be space for further feedback and revisions from participants. However, we have a lot to accomplish during the session and hope to hasten this part of the process by getting your feedback on this list prior the workshop.

Thanks for your willingness to partake in this study, your participation is highly valued and will significantly contribute to the training of new BC farmers using alternative agricultural practices! If you have any questions, feel free to email or call me at the email and/or phone number provided below.

Sincerely,
Sarah Clements

Appendix B-6 Preliminary List of Duties and Tasks

Hello *participant name*,

The research team has compiled a chart of the core responsibilities associated with the alternative farm operator vocation in BC. These core responsibilities are organized into duties (vertical columns) and tasks (horizontal rows) in the chart below. Duties represent the overarching responsibilities associated with the alternative farmer profession. Tasks are specific responsibilities associated with each duty. Tasks include: cognitive skills, motor skills, and affective skills.

Please review the chart provide below to determine its effectiveness in fully describing the profession of alternative farm operator in BC. We ask you to provide us with feedback including the addition, removal, and/or revision duties and tasks. All duties and tasks should be directly related to the profession of alternative farm operator in BC. We also seek to fully and completely describe the profession of alternative farm operator in BC and thus not leave out any relevant duties and tasks.

	Task 1	**Task 2**	**Task 3**	**Task 4**	**Task 5**	**Task 6**	**Task 7**
Duty 1							
Duty 2							
Duty 3							
Duty 4							
Duty 5							

Definitions:

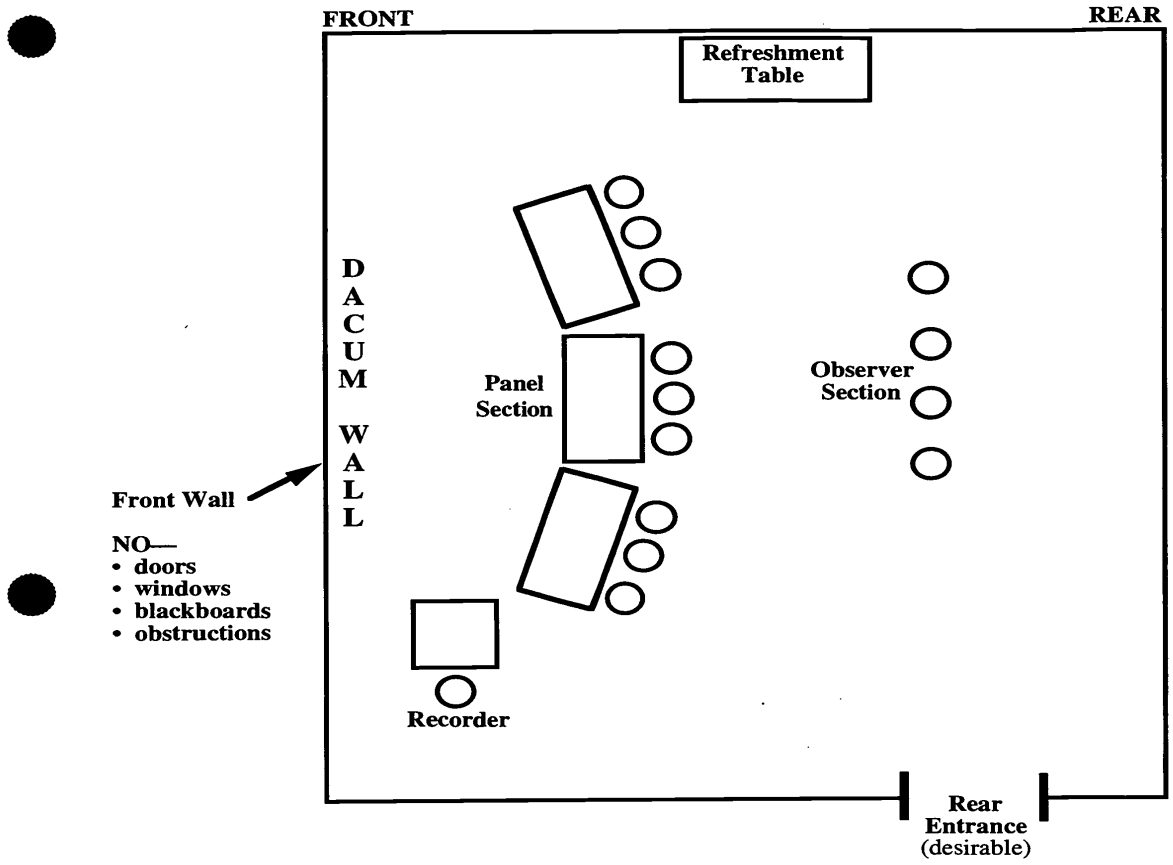
A farm operator is defined as: those persons responsible for the day-to-day management decisions made in the operation of an agricultural operation.

Alternative farming/farmer is defined as: alternative agricultural practices differ from industrial agriculture in their production methods and marketing channels. Alternative agriculture includes farming systems such as organic farming, agroecology, biodynamic, and regenerative and sustainable agriculture.
They have a tendency to employ:

1. Ecological growing practices to minimize adverse environmental effects. These include, but are not limited to crop rotations, cover cropping, sustainable soil management, crop diversity, minimization of synthetic chemical use, etc.
2. Direct-marketing channels such as sales through farmers markets, CSAs, farm-gate, restaurants, food hubs, and/or local groceries.
3. Small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies.

Appendix C – DACUM Workshop Diagrams & Guidelines

Appendix C-1 DACUM Workshop Layout

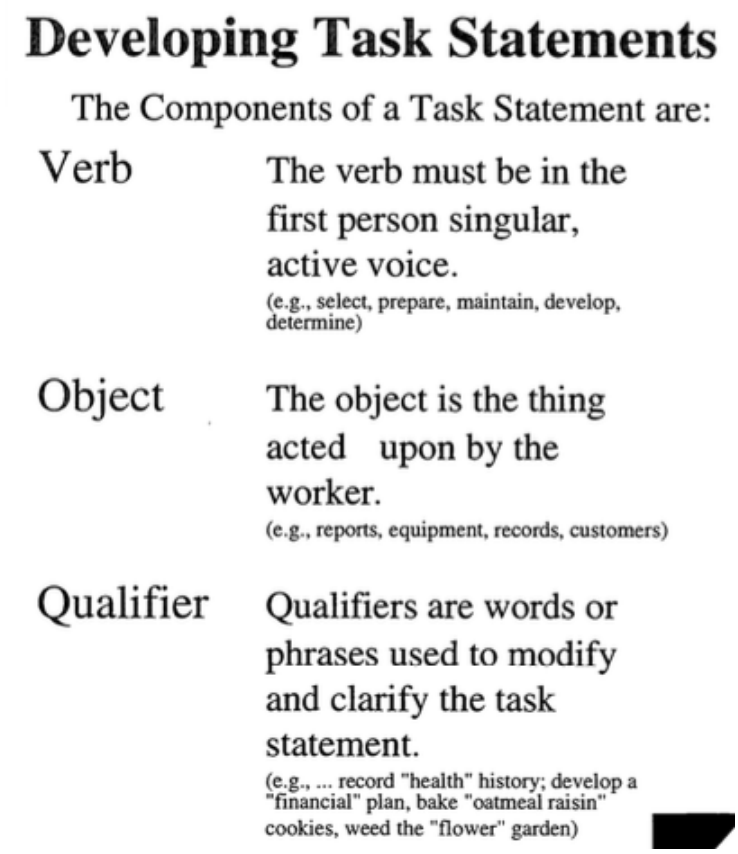


Suggested room arrangement for a DACUM workshop

Source: *The DACUM Coordinator: A Training Manual* developed for the South Carolina Technical Education System, Columbia, South Carolina, 1983.

(Norton, 1985)

Appendix C-2 Task Statement Structure



Developing Task Statements

The Components of a Task Statement are:

Verb — The verb must be in the first person singular, active voice.
(e.g., select, prepare, maintain, develop, determine)

Object — The object is the thing acted upon by the worker.
(e.g., reports, equipment, records, customers)

Qualifier — Qualifiers are words or phrases used to modify and clarify the task statement.
(e.g., ... record "health" history; develop a "financial" plan, bake "oatmeal raisin" cookies, weed the "flower" garden)

(Norton, 1985)

Appendix D – DACUM Workshop Results

Appendix D-1: DACUM Chart from DACUM workshop

A - Manage Livestock Operations	A-1 Create livestock production plan	A-2 Establish flock or animal ID system	A-3 Create and execute daily chore schedule	A-4 Obtain feed and supplements	A-5 Manage pasture rotations
	A-6 Create and execute waste resource plan	A-7 Monitor livestock health	A-8 Cull sick or injured animals	A-9 Identify animal health and welfare resources and requirements	A-10 Assess animal welfare and ethics
	A-11 Create and execute slaughter plan	A-12 Conduct further processing of products			
B – Manage Perennial Crop Production	B-1 Design perennial crop plan (e.g. select root stock, identify crops, design systems)	B-2 Create and execute irrigation plan	B-3 Propagate crops (e.g. grafting, budding)	B-4 Develop and adhere to spray schedule	B-5 Develop and maintain crop supports (e.g. trellises)
	B-6 Manage understory, floor, and non-production areas	B-7 Prune crops (for both disease and canopy management)	B-8 Manage crop load	B-9 Assess fruit maturation	B-10 Renew/renovate beds
	B-11 Establish and maintain hedgerow				
C – Manage Vegetable Crop Production	C-1 Create crop plan (incl. seed order, planting schedule, crop selection)	C-2 Create and execute propagation plan	C-3 Direct sow crops	C-4 Transplant crops (incl. seedlings, tubers)	C-5 Record seeding and planting
	C-6 Assess crop specific fertility requirements	C-7 Assess plant health	C-8 Apply appropriate soil fertility and amendments	C-9 Conduct crop specific maintenance plan (e.g. hilling, trellising, pruning)	
D – Manage Harvest and Post-Harvest Handling of Crops	D-1 Create SOP's for harvest and post-harvest activities	D-2 Create weekly harvest plans	D-3 Assess plant maturity for harvest	D-4 Project crop yield	D-5 Prepare harvest tools and supplies
	D-6 Clean harvest equipment and facilities	D-7 Follow food safety standards	D-8 Harvest crop to farm standards	D-9 Record crop harvest	D-10 Perform quality control

	D-11 Process crops to farm standards	D-12 Pack crops for distribution	D-13 Manage cullage	D-14 Make value-added products	
E – Manage Pests, Weeds and Diseases	E-1 Assess pest pressure/damage	E-2 Identify pests (e.g. weeds, disease, insects)	E-3 Determine pest control method	E-4 Identify resources available for pest management	E-5 Apply preventative approved pest control measures
	E-6 Record pest control method	E-7 Manage weeds appropriately	E-8 Manage biosecurity		
F – Operate Farm Equipment and Tools	F-1 Research equipment and tools	F-2 Determine short and long-term equipment and tool needs	F-3 Operate equipment and tools safely and effectively	F-4 Operate farm vehicles	F-5 Create SOP's for tools and equipment
	F-6 Select the right tool for the job	F-7 Clean tools and equipment	F-8 Sharpen tools	F-9 Follow seasonal service protocol	F-10 Repair tools and equipment
	F-11 Troubleshoot mechanical problems	F-12 Inspect production equipment and facilities			
G – Manage Farm Infrastructure	G-1 Construct infrastructure	G-2 Evaluate infrastructure	G-3 Maintain infrastructure (e.g. roads, fences, hedgerows)	G-4 Establish preventative maintenance schedule	G-5 Repair infrastructure
	G-6 Demolish unnecessary infrastructure	G-7 Conduct basic electrical	G-8 Conduct basic plumbing	G-9 Conduct basic carpentry	
H – Steward Soil Health	H-1 Create soil health plan	H-2 Identify soil health resources	H-3 Execute soil health plan	H-4 Determine soil management based on soil properties	H-5 Conduct soil samples
	H-6 Interpret soil tests	H-7 Manage soil fertility	H-8 Manage organic matter	H-9 Manage composting systems	H-10 Manage soil water
I – Manage Water Resources	I-1 Monitor and maintain water quality	I-2 Assess irrigation needs	I-3 Assess drainage needs	I-4 Create water supply chain plan	I-5 Adhere to local regulations
	I-6 Execute water supply chain plan	I-7 Manage irrigation needs	I-8 Manage drainage	I-9 Conserve water resources	
J – Manage Human Resources	J-1 Determine staffing needs	J-2 Research worker grants and subsidies	J-3 Create job descriptions (incl. owners,	J-4 Recruit job applicants	J-5 Conduct interviews

			managers, seasonal staff)		
	J-6 Establish employment contracts	J-7 Train employees (incl. orientation)	J-8 Establish communications protocol for staff	J-9 Establish employee health & safety protocol	J-10 Facilitate staff goal setting
	J-11 Manage WorkSafe BC requirements	J-12 Establish HR/staffing policies (e.g. employee handbook)	J-13 Manage payroll and accounting	J-14 Delegate tasks to staff	J-15 Oversee staff work
	J-16 Evaluate staff performance	J-17 Solicit staff feedback	J-18 Align staff skills with farm needs	J-19 Resolve employee issues/conflict	
K – Manage Farm Business Administration	K-1 Develop business plan	K-2 Set short and long-term goals	K-3 Establish business legal structure	K-4 Obtain necessary licenses, permits and certifications	K-5 Secure access to land (e.g. purchase land, negotiate lease agreements)
	K-6 Develop SOP's	K-7 Develop risk management plan	K-8 Identify contractor needs (e.g. bookkeeper, electrician, etc.)	K-9 Maintain insurance policies	K-10 Order and track inventory
	K-11 Procure tools, equipment and supplies	K-12 Maintain record keeping systems	K-13 Manage communications (e.g. emails)	K-14 Manage farm safety and security	K-15 Create farm succession plan
L – Manage Farm Finances	L-1 Manage overall farm budget	L-2 Source funds	L-3 Manage bookkeeping systems	L-4 Keep financial records	L-5 Manage short and long-term debt
	L-6 Pay taxes	L-7 Create enterprise budgets	L-8 Evaluate profitability of enterprises		
M – Develop Farm Marketing and Sales Plan	M-1 Conduct market research	M-2 Evaluate sales trends	M-3 Evaluate marketing needs	M-4 Create marketing strategy (e.g. 4 P's: Product, Place, Price, Promotion)	M-5 Select appropriate marketing technology and tools for target demographic
	M-6 Develop marketing materials	M-7 Develop brand	M-8 Maintain online/social media presence	M-9 Communicate with customers	M-10 Manage customer relationships
	M-11 Manage sales accounts	M-12 Sell at farmers markets	M-13 Handle cash, till, and POS software		

N – Engage in Community	N-1 Conduct education and outreach activities	N-2 Host community events and farm tours	N-3 Maintain friendly relationship with neighbours	N-4 Establish relationships with other farmers, businesses and organizations	N-5 Promote sustainable local farming and food systems security
	N-6 Patronize local businesses	N-7 Acknowledge and engage with indigenous communities			
O – Pursue Professional Development	O-1 Find a farm mentor	O-2 Observe farm daily	O-3 Keep a farm journal	O-4 Read agricultural literature	O-5 Visit other farms
	O-6 Establish relationship with local institutions and organizations	O-7 Attend classes, conferences and workshops	O-8 Keep posted on current events and trends	O-9 Learn from experience	

Appendix E – Survey Recruitment, Consent Form and Content

Appendix E-1 Survey Participant Initial Email Contact

Hello _____,

My name is _____ and I am emailing you on behalf of the Institute for Sustainable Food Systems at Kwantlen Polytechnic University and the Center for Sustainable Food Systems at the UBC Farm. I obtained your name and contact information from (name of organization), and am calling to inquire about your potential to participate in a research project we are conducting *to develop instructional materials for existing agricultural education programs that train new alternative farmers in BC, such as the Tsawwassen Farm School, the Richmond Farm School and the Practicum in Sustainable at the UBC Farm, as well as support the development of new programs across the province and country.*

Research Process & Participant Involvement
The goal of this research is to develop comprehensive instructional materials to use in programs intending to train new alternative farmers. To do this we are hoping to engage 200 alternative farmers from across the province in dialogue about how new alternative farmers should be trained. We are asking alternative farmers in BC to fill out a fifteen-minute questionnaire that asks them to identify the core responsibilities associated with their vocation and the most effective teaching methods associated with these responsibilities. This will help us construct teaching materials for alternative agricultural education programs that train new farmers in the province.

Farm operators are defined as: those persons responsible for the day-to-day management decisions made in the operation of an agricultural operation.
Alternative farmers/farming is defined as: alternative agricultural practices differ from industrial agriculture in their production methods and marketing channels. Alternative agriculture includes farming systems such as organic farming, agroecology, biodynamic, and regenerative and sustainable agriculture.
They have a tendency to employ:

1. Ecological growing practices to minimize adverse environmental effects. These include, but are not limited to crop rotations, cover cropping, sustainable soil management, crop diversity, minimization of synthetic chemical use, etc.
2. Direct-marketing channels such as sales through farmers markets, CSAs, farm-gate, restaurants, food hubs, and/or local groceries.
3. Small-scale, or human-scale production methods that avoid highly mechanized, industrial production technologies.

Benefits
Participants will contribute to the development of instructional materials used to train new alternative farmers in BC. This will enhance effective training of new farmers as competent and successful future farm owners, managers and employees in the alternative agricultural sector in

BC. Further benefits of participating in this study include: influence the training and development of new farmers in BC, fostering community connections amongst the alternative agriculture sector in the province, and contributing to the start-up and success of farmer training programs in the province.

All participants will be entered in a raffle to win a $200 gift card for participating in the study.

Voluntary Participation: Participating in this research is entirely voluntary. You have the right to withdraw from the research process at any time without providing any justification and without consequence. Declining to participate in this research will not affect your personal or professional reputation in any way.

Confidentiality: Participants will have the option to remain anonymous before beginning the questionnaire. Those participants that choose to include their name, business, or organization in questionnaire demographic information, will not be identified by name in any reports or publications upon the completion of the study.

All hard copies of documents will be identified using a code number and kept in a locked filing cabinet in the office of the researcher at the Kwantlen Polytechnic University Richmond campus. Survey participants will not be identified by name in any research document. Electronic copies of survey data will be kept in password protected, local hard drives of the research team. Data will be stored for no longer than five years. After five years, all project data will be destroyed.

Do you have any questions about the project?
Please email the graduate student researcher, Sarah Clements.

Would you like to participate?
If you agree to participate in the study, please click on the questionnaire link provided. Prior to the start of the questionnaire, you will be required to sign a consent form detailing the research purpose, procedures, and confidentiality agreement. This consent form can be found by clicking the questionnaire link provided.

Thank you for your participation!

Appendix E-2 Letter of Informed Consent

Q1
Effectively Training New BC Farmers in Alternative Agricultural Practices

What is this study about?
The purpose of this study is to understand the perspectives of alternative farmers in BC regarding what new and aspiring alternative farmers should be taught in order to be successful.

Alternative farmers/farming is defined as:
Alternative agricultural practices differ from industrial agriculture in their production methods and marketing channels. Alternative agriculture includes farming systems such as organic farming, agroecology, biodynamic, and regenerative and sustainable agriculture.

Alternative farmers have a tendency to:Employ ecological growing practices to maximize ecosystem, soil and water health. These include: crop rotations, covercropping, sustainable soil management, integrated livestock/cropping systems, etc.Sell to: farmers markets, CSA's, farm-gate, restaurants, food hubs, local groceries and/or wholesale markets.Employ farming business practices that foster human, farm worker, and community health.Use livestock production techniques that foster animal health, welfare and well being.

Specifically, this survey asks alternative farmers in BC to identify the core responsibilities (referred to as duties) and the specific responsibilities (referred to as tasks) associated with each duty, associated with their profession. **This information will be used to better understand what new alternative farmers in BC should be taught to be successful.**

What are we asking of you?
We are asking you to participate in this study because **you identify as an alternative farmer in BC**. **The survey can be completed online in approximately 15 to 20 minutes.** You can pause and come back to complete the survey at anytime (within two weeks of starting) and may terminate your participation in the survey at any time. Please review the informed consent form below and contact the graduate student investigator if you have any questions.

All participants will be given the chance to win one of ten $100 Visa giftcards by completing the survey. To participate in the raffle you will be asked to enter your contact information in the following question.

Your participation in this study is entirely voluntary. Very minimal risk is anticipated from participating in this project and you have the right to terminate the survey at any time and for any reason without consequence. If you choose to withdraw, all data that you have provided will be immediately destroyed.

How will your privacy be maintained?
All participant information collected from this survey will be kept confidential and will only be accessed by the research team.

All hard copies of tabulated data (survey results) will be identified using a code number and kept in a locked filing cabinet in the office of the graduate student researcher at the Kwantlen Polytechnic University Richmond campus and the office of the co-PI at the UBC, Vancouver campus. Electronic copies of survey data will be kept in password protected, encrypted local hard drives by the research team. Data will be stored for three years. After three years, all project data will be destroyed.

How will the survey results be used?
The results of this research will be used to create an instructional document that will be published for use in new and existing, alternative farmer training programs such as the Tsawwassen First Nation Farm School, Richmond Farm School and the Practicum in Sustainable Agriculture at the UBC Farm. The instructional document will be made open-source to support the development of new alternative farmer training and extension programs in BC and across Canada. Study results will be published in journal articles, project summaries, plain-language community briefs, and in an MSc thesis.

For further information, please contact:
Graduate Student Investigator:
Sarah Clements, MSc Candidate, Integrated Studies in Land and Food Systems, the University of British Columbia
Research and Extension Associate, Institute for Sustainable Food Systems, Kwantlen Polytechnic University
[redacted]

Principle Investigator:
Dr. Kent Mullinix, PhD, Director, Institute for Sustainable Food Systems,
Kwantlen Polytechnic University
[redacted]

Co-Investigator:
Dr. Maja Krzic, PhD, Associate Professor Applied Biology/Forest and Conservation Studies
University of British Columbia
[redacted]

If you have concerns or complaints:
If you have any concerns or complaints about your rights as a research participant, and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Ethics at 604-822-8598 or if long distance e-mail to RSIL@ors.ubc.ca or call toll free 1-877-822-8598; or the Kwantlen Office of Research and Scholarship at 604-599-2373. All other concerns or complaints may be directed to the Principle-Investigator, Dr. Kent Mullinix ([redacted]) and/or the Co-Investigator Dr. Maja Krzic ([redacted]).

If you would like to be contacted with the results of this research
If you would like to receive the study results, please provide us with your contact information at the end of the survey.

Funding:
This project is funded by the Institute for Sustainable Food Systems (ISFS) at Kwantlen Polytechnic University; the Center for Sustainable Food Systems (CSFS) at the UBC Farm; and VanCity Credit Union.

Q2 **Do you consent to participating in this survey?**

You are required to click the button next to 'I consent' to continue, you must consent before participating in this survey.

To save or print the consent form for your records, either copy and paste the text into a document, or go to 'print' from your browser's menu, and click 'save as pdf'.

- ○ I consent (4)

Page Break

Q3 Would you like to enter a raffle for the chance to win a prize?

- ○ Yes (1)
- ○ No (2)

Page Break

Appendix E-3 Survey Content

Display This Question:

If Would you like to enter a raffle for the chance to win a prize? = Yes

Q4 Please enter your name and contact information for the chance to win one of ten $100 VISA giftcards.

- Name (1) _____
- Preferred Phone (2) _____
- Email (3) _____

End of Block: Consent Form

Start of Block: Screening Questions

Q5 Do you currently live in BC?

*this survey is targeted at alternative farmers who live in BC, if you are not currently a resident the survey will be terminated at this time.

- Yes (1)
- No (2)
- N/A (3)

*Skip To: End of Survey If Do you currently live in BC? *this survey is targeted at alternative farmers who live in BC, i... = No*

*Skip To: End of Survey If Do you currently live in BC? *this survey is targeted at alternative farmers who live in BC, i... = N/A*

Q6 Which of the following occupational titles do you identify with, if any?

*this survey seeks to hear from farm operators, managers, and/or workers; if you do not identify as a farm operator, manager or worker, please exit the survey at this time.

- ○ Farm owner/operator (1)
- ○ Farm manager (2)
- ○ Farm worker (3)
- ○ Other (4) _____
- ○ N/A (5)

Q7 Please check the box next to the type of organization(s) you are affiliated with, if any. *Check all that apply.*

- ☐ Private business (1)
- ☐ University (2)
- ☐ Government (3)
- ☐ Institute (4)
- ☐ Non-profit (5)
- ☐ Charity (6)
- ☐ N/A (7)
- ☐ Other, please specify (8) _____

Q8 Are your farming practices aligned with one or more of the following agricultural approaches? *Check all that apply.*

- ☐ Sustainable Agriculture (1)
- ☐ Regenerative Agriculture (2)
- ☐ Agroecology (3)
- ☐ Certified Organic (4)
- ☐ Biodynamic (5)
- ☐ Alternative agriculture (6)
- ☐ N/A (7)
- ☐ Other, please specify (8) _____

Q9 What type of agricultural enterprises do you have on your farm? Check all that apply.

- ☐ Livestock (e.g. pigs, chickens, goats, cattle) (1)
- ☐ Vegetable crops (2)
- ☐ Tree fruits/small fruits and/or other perennial crops (3)
- ☐ Grain/oil crops (4)
- ☐ Forage crops (5)
- ☐ Other, please specify (6) _____

Q10 Please select the general, overarching responsibilities (referred to as duties) associated with your occupation as an alternative farmer from the list below. *Select all that apply.*

- ☐ Farm Business Administration (1)
- ☐ Human Resources Management (2)
- ☐ Farm Financial Management (3)
- ☐ Farm Product Marketing and Sales (4)
- ☐ Production of Vegetable Crops (5)
- ☐ Perennial Crop Production (6)
- ☐ Livestock Operations (7)
- ☐ Harvest and Post-harvest Handling of Crops (8)
- ☐ Pest Management (Insects, mites, weeds and diseases) (9)
- ☐ Operation of Farm Machinery and Equipment (10)
- ☐ Farm Infrastructure Management (11)
- ☐ Soil Health Stewardship (12)
- ☐ Water Resources Management (13)
- ☐ Professional Development (15)
- ☐ Community Engagement and Outreach (16)
- ☐ Other, please specify (17) _____

Q11
The following set of questions will ask you to indicate the importance of specific tasks associated with the occupation of alternative farmer. Tasks will be organized according to the duty areas listed in the previous question. Duty areas and associated tasks are not presented in any prioritized order.

Please consider each task statement carefully and assess its importance to the occupation of alternative farmer.

Page Break

Q12 Do you now or have you previously engaged in alternative farming work associated with the duty category of ***livestock operations?***

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q15 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q14 List any tasks associated with the category of ***livestock operations*****,** that are not listed above:

_____

Q13 Rate the importance of each task associated with the category of ***livestock operations***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not sure (4)

Create livestock production plan (1)	○	○	○	○
Establish flock or animal ID system (2)	○	○	○	○
Create and execute daily chore schedule (3)	○	○	○	○
Obtain feed and supplements (4)	○	○	○	○
Manage pasture rotations (5)	○	○	○	○
Create and execute waste resource plan (e.g. offal) (6)	○	○	○	○
Monitor livestock health (7)	○	○	○	○
Cull sick or injured animals (8)	○	○	○	○
Identify animal health and welfare resources/requirements (9)	○	○	○	○
Assess animal welfare and ethics (10)	○	○	○	○
Create and execute slaughter plan (11)	○	○	○	○
Conduct further processing of products (12)	○	○	○	○

Page Break

Q15 Do you now or have you previously engaged in alternative farming work associated with the duty category of ***perennial crop production?***

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q18 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q16 Rate the importance of each task associated with the category of ***perennial crop production***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not sure (4)

Design perennial crop plan (e.g. select root stock, identify crops, design systems) (1)	○	○	○	○
Create and execute irrigation plan (2)	○	○	○	○
Propagate crops (e.g. grafting, budding) (3)	○	○	○	○
Develop and adhere to spray schedule (4)	○	○	○	○
Develop and maintain crop supports (e.g. trellises) (5)	○	○	○	○
Manage understory, floor, and non-production areas (6)	○	○	○	○
Prune crops (for both disease and canopy management) (7)	○	○	○	○
Manage crop load (8)	○	○	○	○
Assess fruit maturation (9)	○	○	○	○
Renew/renovate beds (10)	○	○	○	○
Establish and maintain hedgerow (11)	○	○	○	○

Q17 List any tasks associated with the category of ***perennial crop production*****,** that are not listed above:

_____

Page Break

Q18 Do you now or have you previously engaged in alternative farming work associated with the duty category of ***vegetable crop production?***

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q21 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q19 Rate the importance of each task associated with category of ***vegetable crop production***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Create crop plan (incl. seed order, planting schedule, crop selection) (1)	○	○	○	○
Create and execute propagation plan (2)	○	○	○	○
Direct sow crops (3)	○	○	○	○
Transplant crops (incl. seedlings, tubers) (4)	○	○	○	○
Record seeding and planting (5)	○	○	○	○
Assess crop specific fertility requirements (6)	○	○	○	○
Assess plant health (7)	○	○	○	○
Apply appropriate soil fertility and amendments (8)	○	○	○	○
Conduct crop specific maintenance plan (e.g. hilling, trellising, pruning) (9)	○	○	○	○

Q20 List any tasks associated with the category of ***vegetable crop production*****,** that are not listed above:

_____

Page Break

Q21 Do you now or have you previously engaged in alternative farming work associated with the duty category of *harvest and post-harvest handling of crops*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q24 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q22 Rate the importance of each task associated with the category of ***harvest and post-harvest handling of crops***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Create SOP's for harvest and post-harvest activities (1)	○	○	○	○
Create weekly harvest plans (2)	○	○	○	○
Assess plant maturity for harvest (3)	○	○	○	○
Project crop yield (4)	○	○	○	○
Prepare harvest tools and supplies (5)	○	○	○	○
Clean harvest equipment and facilities (6)	○	○	○	○
Follow food safety standards (7)	○	○	○	○
Harvest crop to farm standards (8)	○	○	○	○
Record crop harvest (9)	○	○	○	○
Perform quality control (10)	○	○	○	○
Process crops to farm standards (11)	○	○	○	○
Pack crops for distribution (12)	○	○	○	○
Manage cullage (13)	○	○	○	○
Make value-added products (14)	○	○	○	○

Q23 List any tasks associated with the category of ***harvest and post-harvest handling of crops*****,** that are not listed above:

_____

Page Break

Q24 Do you now or have you previously engaged in alternative farming work associated with the duty category of *pest management (insects, mites, weeds, and diseases)*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q27 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q25 Rate the importance of each task associated with the category of ***pest management (insects, mites, weeds, and diseases)***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Assess pest pressure/damage (1)	○	○	○	○
Identify pests (e.g. weeds, disease, insects) (2)	○	○	○	○
Determine pest control method (3)	○	○	○	○
Identify resources available for pest management (4)	○	○	○	○
Apply preventative measures for crops (5)	○	○	○	○
Implement approved pest control measures (6)	○	○	○	○
Record pest control method (7)	○	○	○	○
Manage weeds appropriately (9)	○	○	○	○
Manage biosecurity (10)	○	○	○	○

Q26 List any tasks associated with the category of *pest management (insects, mites, weeds, and diseases)* that are not listed above:

_____

Page Break

Q27 Do you now or have you previously engaged in alternative farming work associated with the duty category of *the operation of farm machinery and equipment?*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q30 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q28 Rate the importance of each task associated with the category of *the operation of farm machinery and equipment*

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Research equipment and tools (1)	○	○	○	○
Determine short and long-term equipment and tool needs (2)	○	○	○	○
Operate equipment and tools safely and effectively (3)	○	○	○	○
Operate farm vehicles (4)	○	○	○	○
Create SOP's for tools & equipment (5)	○	○	○	○
Select the right tool for the job (6)	○	○	○	○
Clean tools and equipment (7)	○	○	○	○
Sharpen tools (8)	○	○	○	○
Follow seasonal service protocol (9)	○	○	○	○
Repair tools and equipment (10)	○	○	○	○
Troubleshoot mechanical problems (11)	○	○	○	○
Inspect production equipment and facilities (12)	○	○	○	○

Q29 List any tasks associated with the category of *the operation of farm machinery and equipment***,** that are not listed above:

_____

Page Break

Q30 Do you now or have you previously engaged in alternative farming work associated with the duty category of *farm infrastructure management?*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q33 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q31 Rate the importance of each task associated with the category of ***farm infrastructure management***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Construct infrastructure (1)	○	○	○	○
Evaluate infrastructure (2)	○	○	○	○
Maintain farm infrastructure (e.g. roads, fences, hedgerows) (3)	○	○	○	○
Establish preventative maintenance schedule (4)	○	○	○	○
Repair infrastructure (5)	○	○	○	○
Demolish unnecessary infrastructure (6)	○	○	○	○
Conduct basic electrical (7)	○	○	○	○
Conduct basic plumbing (8)	○	○	○	○
Conduct basic carpentry (9)	○	○	○	○

Q32 List any tasks associated with the category of ***farm infrastructure management*****,** that are not listed above:

_____

Page Break

Q33 Do you now or have you previously engaged in alternative farming work associated with the duty category of *soil health stewardship?*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q36 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q34 Rate the importance of each task associated with the category of ***soil health stewardship***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Create soil health plan (1)	○	○	○	○
Identify soil health resources (2)	○	○	○	○
Execute soil health plan (3)	○	○	○	○
Determine soil management based on soil properties (4)	○	○	○	○
Conduct soil samples (5)	○	○	○	○
Interpret soil tests (6)	○	○	○	○
Manage soil fertility (7)	○	○	○	○
Manage organic matter (8)	○	○	○	○
Manage composting systems (9)	○	○	○	○
Manage soil water (10)	○	○	○	○

Q35 List any tasks associated with the category of ***soil health stewardship,*** that are not listed above:

_____

Page Break

Q36 Do you now or have you previously engaged in alternative farming work associated with the duty category of *water resources management?*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q39 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q37 Rate the importance of each task associated with the category of ***water resources management***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)
Monitor and maintain water quality (1)	○	○	○	○
Assess irrigation needs (2)	○	○	○	○
Assess drainage needs (3)	○	○	○	○
Create water supply chain plan (4)	○	○	○	○
Adhere to local regulations (5)	○	○	○	○
Execute water supply chain plan (6)	○	○	○	○
Manage irrigation needs (7)	○	○	○	○
Manage drainage (8)	○	○	○	○
Conserve water resources (9)	○	○	○	○

Q38 List any tasks associated with the category of ***water resources management*****,** that are not listed above:

_____

Page Break

Q39 Do you now or have you previously engaged in alternative farming work associated with the duty category of ***human resources management***?

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q42 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q40 Rate the importance of each task associated with the category of ***human resources management***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Determine staffing needs (1)	○	○	○	○
Research worker grants and subsidies (2)	○	○	○	○
Create job descriptions (incl. owners, managers, seasonal staff) (3)	○	○	○	○
Recruit job applicants (4)	○	○	○	○
Conduct interviews (5)	○	○	○	○
Establish employment contracts (6)	○	○	○	○
Train employees (incl. orientation) (7)	○	○	○	○
Establish communications protocol for staff (8)	○	○	○	○
Establish employee heath & safety protocol (9)	○	○	○	○
Facilitate staff goal setting (10)	○	○	○	○
Manage WorkSafe BC requirements (11)	○	○	○	○
Establish HR / staffing policies (e.g. employee handbook) (12)	○	○	○	○
Manage Payroll and accounting (13)	○	○	○	○
Delegate tasks to staff (14)	○	○	○	○

Oversee staff work (15)	○	○	○	○
Evaluate staff performance (16)	○	○	○	○
Solicit staff feedback (17)	○	○	○	○
Align staff skills with farm needs (18)	○	○	○	○
Resolve employee issues/conflict (19)	○	○	○	○

Q41 List any tasks associated with the category of ***human resources management***, that are not listed above:

_____

Page Break

Q42 Do you now or have you previously engaged in alternative farming work associated with the duty category of ***farm business administration?***

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q45 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q43 Rate the importance of each task associated with the category of *farm business administration*

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Develop business plan (1)	○	○	○	○
Set short and long-term goals (2)	○	○	○	○
Establish business legal structure (3)	○	○	○	○
Obtain necessary licenses, permits and certifications (4)	○	○	○	○
Secure access to land (e.g. purchase land, negotiate lease agreements) (5)	○	○	○	○
Develop SOPs (6)	○	○	○	○
Develop risk management plan (7)	○	○	○	○
Identify contractor needs (e.g. bookkeeper, electrician, etc.) (8)	○	○	○	○
Maintain insurance policies (9)	○	○	○	○
Order and track inventory (10)	○	○	○	○
Procure tools, equipment and supplies (11)	○	○	○	○
Maintain record keeping systems (12)	○	○	○	○
Manage communications (e.g. emails) (13)	○	○	○	○

Manage farm safety and security (14)	○	○	○	○
Create farm succession plan (17)	○	○	○	○

Q44 List any tasks associated with the category of ***farm business administration*****,** that are not listed above:

_____

Page Break

Q45 Do you now or have you previously engaged in alternative farming work associated with the duty category of ***farm financial management?***

*If you select no, you will be directed to the next question set.

- ○ Yes (1)
- ○ No (2)

Skip To: Q48 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q46 Rate the importance of each task associated with the category of ***farm financial management***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)
Manage overall farm budget (1)	○	○	○	○
Source funds (2)	○	○	○	○
Manage bookkeeping systems (3)	○	○	○	○
Keep financial records (4)	○	○	○	○
Manage short and long-term debt (5)	○	○	○	○
Pay taxes (6)	○	○	○	○
Create enterprise budgets (7)	○	○	○	○
Evaluate profitability of enterprises (8)	○	○	○	○

Q47 List any tasks associated with the category of ***farm financial management*****,** that are not listed above:

_____

Page Break

Q48 Do you now or have you previously engaged in alternative farming work associated with the duty category of ***farm product marketing and sales?***

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q51 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q49 Rate the importance of each task associated with the category of ***farm product marketing and sales***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Conduct market research (1)	○	○	○	○
Evaluate sales trends (2)	○	○	○	○
Evaluate marketing needs (3)	○	○	○	○
Create marketing strategy (e.g. 4 P's: Product, Place, Price, Promotion) (4)	○	○	○	○
Select appropriate marketing technology and tools for target demographic (5)	○	○	○	○
Develop marketing materials (6)	○	○	○	○
Develop Brand (7)	○	○	○	○
Maintain online/social media presence (8)	○	○	○	○
Communicate with customers (9)	○	○	○	○
Manage customer relationships (10)	○	○	○	○
Manage sales accounts (11)	○	○	○	○
Sell at farmers markets (12)	○	○	○	○
Handle cash, till, and POS software (13)	○	○	○	○

Q50 List any tasks associated with the category of *farm product marketing and sales*, that are not listed above:

_____

Page Break

Q51 Do you now or have you previously engaged in alternative farming work associated with the duty category of *community engagement and outreach?*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: Q54 If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q52 Rate the importance of each task associated with the category of ***community engagement and outreach***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Conduct education and outreach activities (1)	○	○	○	○
Host community events and farm tours (2)	○	○	○	○
Maintain friendly relationship with neighbours (3)	○	○	○	○
Establish relationships with other farmers, businesses and other organizations (4)	○	○	○	○
Promote sustainable local farming and food systems security (5)	○	○	○	○
Patronize local businesses (6)	○	○	○	○
Acknowledge and engage in indigenous community (7)	○	○	○	○

Q53 List any tasks associated with the category of ***community engagement and outreach,*** that are not listed above:

_____

Page Break

Q54 Do you now or have you previously engaged in alternative farming work associated with the duty category of *professional development?*

**If you select no, you will be directed to the next question set.*

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Do you now or have you previously engaged in alternative farming work associated with the duty ca... = No

Q55 Rate the importance of each task associated with the category of ***professional development***

	Importance			
	Important (1)	Neutral (2)	Not Important (3)	Not Sure (4)

Find a farm mentor (1)	○	○	○	○
Observe farm daily (2)	○	○	○	○
Keep a farm journal (3)	○	○	○	○
Read agricultural literature (4)	○	○	○	○
Visit other farms (5)	○	○	○	○
Establish relationshop with local institutions and organizations (6)	○	○	○	○
Attend classes, conferences, and workshops (7)	○	○	○	○
Keep posted on current events and trends (8)	○	○	○	○
Learn from experience (9)	○	○	○	○

Q56 List any tasks associated with the category of ***professional development,*** that are not listed above:

_____

Page Break

End of Block: Main Survey

Start of Block: Demographic Questions

Q57 What is your age?

- Under 25 (1)
- 25 to 35 (2)
- 36 to 45 (3)
- 46 to 55 (4)
- 56 to 65 (5)
- 66+ (6)
- I prefer not to answer (7)

Q58 With which gender identity do you most identify?

- Male (1)
- Female (2)
- Other (3)
- I prefer not to answer (4)

Q59 Please specify your ethnicity

- [ ] White (1)
- [ ] Black or African American (2)
- [ ] Asian (3)
- [ ] Indigenous or First Nations (5)
- [ ] Hispanic or Latino (6)
- [ ] Métis (7)
- [ ] Other (9)
- [ ] I prefer not to answer (10)

Q60 5. What is your annual farm gross revenue?

- Less than $10,000 (1)
- $10,000 to $40,999 (2)
- $50,000 to $99,999 (3)
- $100,000 to $149,999 (4)
- $150,000 to $199,999 (5)
- $200,000 to $249,999 (6)
- $250,000 to $299,999 (7)
- $300,000 and above (8)
- I prefer not to answer (9)

Q61 What proportion of your household income comes from farm business revenue?

- 0% (1)
- 1-25% (2)
- 26-50% (3)
- 51-75% (4)
- 76-99% (5)
- 100% (6)
- I prefer not to answer (7)

Q62 What is your farm acreage?

- [ ] Total farm acreage (1) _____
- [ ] Acreage in vegetable production (2) _____
- [ ] Acreage in perennial fruit and nut crops (3) _____
- [ ] Acreage in livestock production (4) _____
- [ ] Acreage in other, please specify (5) _____
- [ ] I prefer not to answer (6)

Q63 What is the highest level of education you have completed? *If currently enrolled, choose the highest degree received.*

- ○ Some secondary, no diploma (1)
- ○ Secondary diploma or equivalent (2)
- ○ Some college credit, no degree (3)
- ○ Trade/technical/vocational training (4)
- ○ Bachelor's degree (e.g. BA, BSc) (5)
- ○ Master's degree (e.g. MA, MSc, MEd) (6)
- ○ Professional degree (e.g. MD, DDS, DVM) (7)
- ○ Doctorate degree (e.g. PhD, EdD) (8)
- ○ Other (9)
- ○ I prefer not to answer (10)

Q64 Have you completed some form of agricultural training and/or education before or during your career as an alternative farmer? Please select all that apply.

- ☐ Post-secondary degree in Agriculture or related field (1)
- ☐ Masters degree in Agriculture or related field (2)
- ☐ Farmer training program (e.g. season long certificate program such as a farm school, formal practicum, etc.) (3)
- ☐ Farm apprenticeship or internship (4)
- ☐ Farm employee (5)
- ☐ Farm volunteer (6)
- ☐ Other, please specify (9) _____
- ☐ I have not completed any training and/or education (10)
- ☐ I prefer not to answer (11)

End of Block: Demographic Questions

Start of Block: Block 5

Q65 Would you like to be contacted with study results?

- ○ Yes (1)
- ○ No (2)

Skip To: Q66 If Would you like to be contacted with study results? = Yes
Skip To: End of Survey If Would you like to be contacted with study results? = No

Q66 Please provide your contact information so we can provide you with study results.

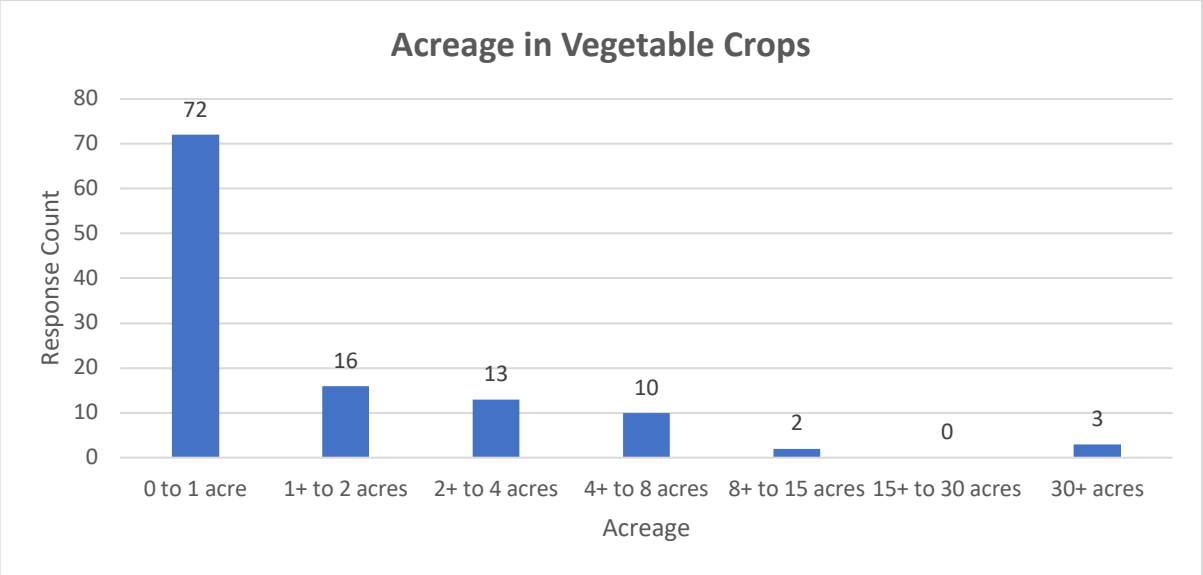
**your contact info will only be seen by the research team and will only be used to send you the results of the study.*

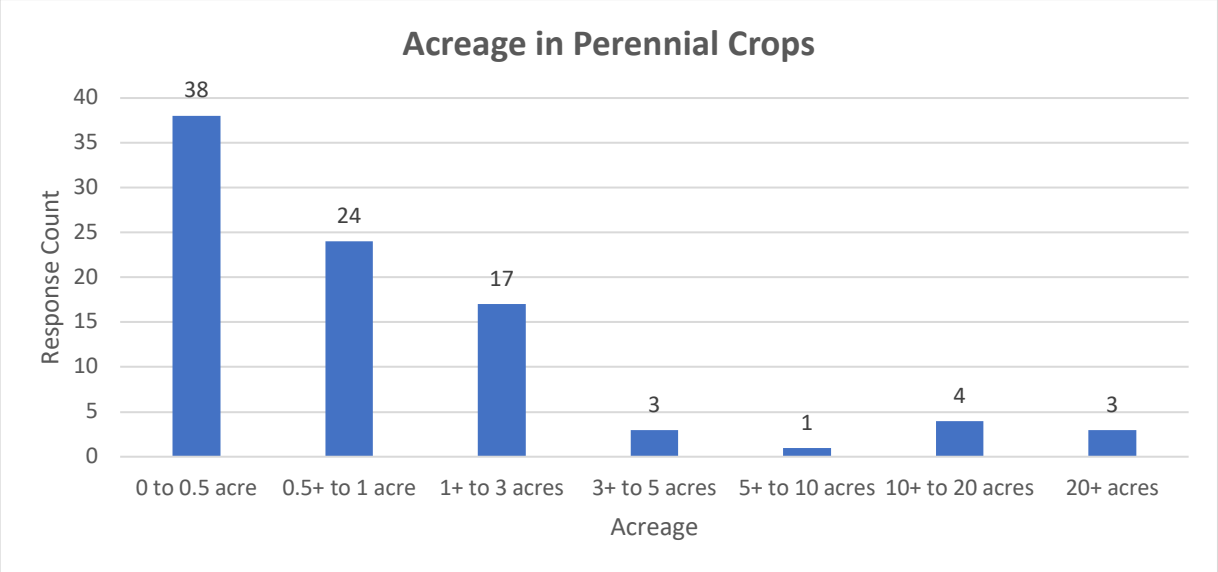
- ○ Name (4) _____
- ○ Email (5) _____

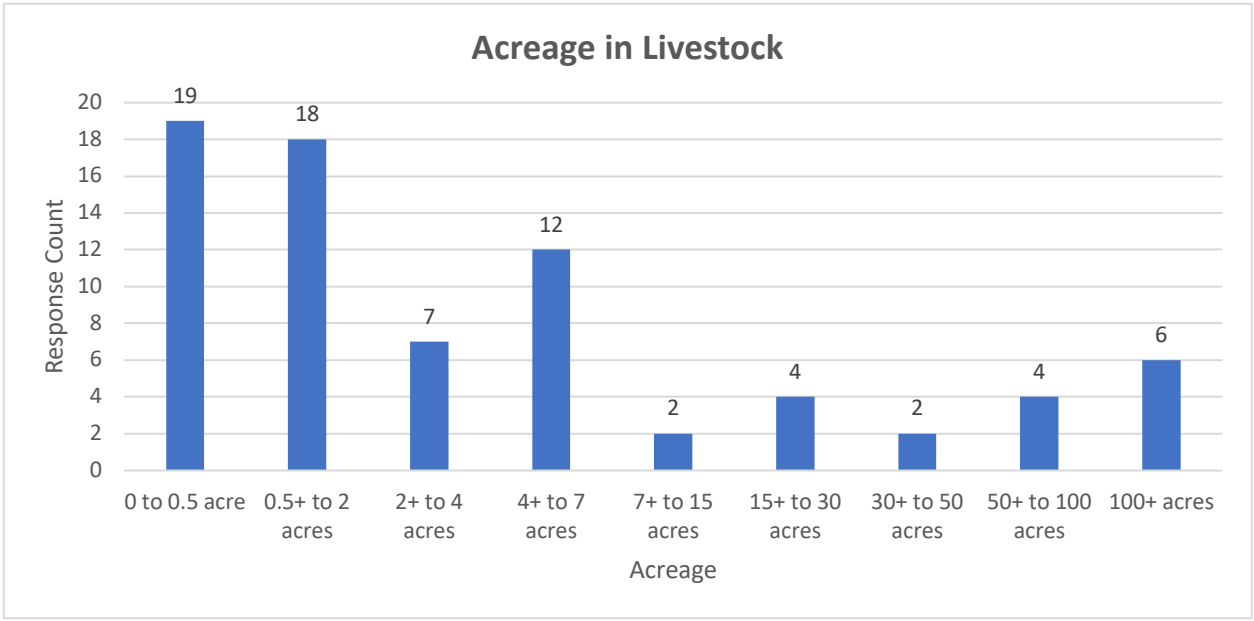
End of Block: Block 5

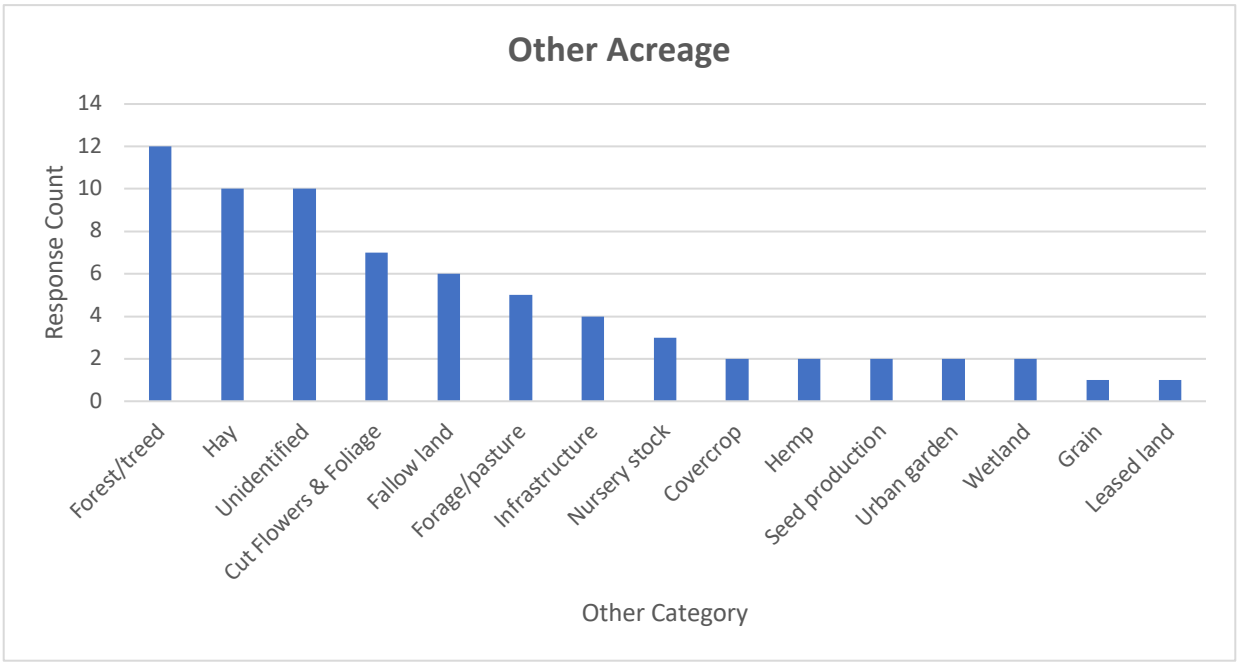
Appendix F – Validation Survey Results

Appendix F-1 Respondent's Acreages in Various Crops






Acreage in Livestock
Response Count
20
18
16
14
12
10
8
6
4
2
0
19
18
7
12
2
4
2
4
6
0 to 0.5 acre
0.5+ to 2 acres
2+ to 4 acres
4+ to 7 acres
7+ to 15 acres
15+ to 30 acres
30+ to 50 acres
50+ to 100 acres
100+ acres
Acreage


Other Acreage
Response Count
14
12
10
8
6
4
2
0
Forest/treed
Hay
Unidentified
Cut Flowers & Foliage
Fallow land
Forage/pasture
Infrastructure
Nursery stock
Covercrop
Hemp
Seed production
Urban garden
Wetland
Grain
Leased land
Other Category

Appendix F-2 Duty Statement Validation Ratings

Duty	**Count**	**Percentage**
Pest Management (insects, mites, weeds and diseases)	143	86.63%
Soil Health Stewardship	142	83.04%
Farm Product Marketing and Sales	142	83.04%
Harvest and Post-Harvest Handling of Crops	141	82.46%
Farm Business Administration	139	81.29%
Farm Financial Management	138	80.70%
Operation of Farm Machinery and Equipment	135	78.95%
Farm Infrastructure Management	133	77.78%
Production of Vegetable Crops	125	73.10%
Water Resources Management	122	71.35%
Community Engagement and Outreach	112	65.50%
Human Resources Management	104	60.82%
Perennial Crop Production	95	55.56%
Professional Development	93	54.39%
Livestock Operations	75	43.86%
Other, please specify	19	11.11%
Total	**171**	**100%**

Appendix F-3 Task Validation Ratings

Duty	Task	Important	Neutral	Not Important	Not sure
Manage Livestock Operations	Monitor livestock health	97.83%	1.09%	1.09%	0.00%
	Obtain feed and supplements	93.48%	4.35%	1.09%	1.09%
	Assess animal welfare and ethics	91.30%	5.43%	1.09%	2.17%
	Identify animal health and welfare resources/requirements	88.04%	7.61%	3.26%	1.09%
	Create and execute daily chore schedule	84.78%	8.70%	5.43%	1.09%
	Manage pasture rotations	84.78%	13.04%	2.17%	0.00%
	Cull sick or injured animals	78.26%	18.48%	2.17%	1.09%
	Create livestock production plan	76.09%	15.22%	5.43%	3.26%
	Create and execute slaughter plan	72.83%	22.83%	4.35%	0.00%
	Create and execute waste resource plan (e.g. offal)	60.87%	29.35%	7.61%	2.17%
	Conduct further processing of products	46.74%	40.22%	10.87%	2.17%
	Establish flock or animal ID system	40.22%	40.22%	15.22%	4.35%
Manage Perennial Crops	Design perennial crop plan (e.g. select root stock, identify crops, succession planting, design systems)	90.53%	8.42%	0.00%	1.05%
	Create and execute irrigation plan	86.32%	13.68%	0.00%	0.00%
	Prune crops (for both disease and canopy management)	84.21%	12.63%	2.11%	1.05%
	Assess fruit maturation	77.89%	16.84%	1.05%	4.21%
	Manage crop load	75.79%	18.95%	3.16%	2.11%
	Renew/renovate beds	69.47%	18.95%	6.32%	5.26%

	Manage understory, floor, and non-production areas	61.05%	31.58%	5.26%	2.11%
	Develop and maintain crop supports (e.g. trellises)	57.89%	28.42%	10.53%	3.16%
	Propagate crops (e.g. grafting, budding)	48.42%	40.00%	9.47%	2.11%
	Establish and maintain hedgerow	43.16%	37.89%	14.74%	4.21%
	Develop and adhere to spray schedule	26.32%	35.79%	30.53%	7.37%
Manage Vegetable Crops	Create crop plan (incl. seed order, planting schedule, crop selection)	97.04%	2.22%	0.74%	0.00%
	Transplant crops (incl. seedlings, tubers)	96.30%	2.22%	1.48%	0.00%
	Assess plant health	91.85%	7.41%	0.74%	0.00%
	Direct sow crops	91.11%	6.67%	2.22%	0.00%
	Apply appropriate soil fertility and amendments	89.63%	8.15%	2.22%	0.00%
	Conduct crop specific maintenance plan (e.g. hilling, trellising, pruning)	89.63%	8.89%	1.48%	0.00%
	Create and execute propagation plan	83.70%	13.33%	1.48%	1.48%
	Record seeding and planting	83.70%	13.33%	2.96%	0.00%
	Assess crop specific fertility requirements	74.81%	20.74%	3.70%	0.74%
Manage Harvest and Post-Harvest Handling	Assess plant maturity for harvest	94.33%	4.96%	0.71%	0.00%
	Clean harvest equipment and facilities	89.36%	9.22%	1.42%	0.00%
	Perform quality control	89.36%	9.22%	0.71%	0.71%
	Pack crops for distribution	88.65%	7.80%	2.84%	0.71%
	Harvest crop to farm standards	87.94%	8.51%	1.42%	2.13%

	Process crops to farm standards	85.11%	8.51%	3.55%	2.84%
	Follow food safety standards	83.69%	12.06%	3.55%	0.71%
	Prepare harvest tools and supplies	82.27%	14.89%	2.84%	0.00%
	Record crop harvest	76.60%	21.99%	0.71%	0.71%
	Project crop yield	67.38%	28.37%	4.26%	0.00%
	Manage cullage	65.96%	26.95%	4.96%	2.13%
	Create weekly harvest plans	64.54%	26.95%	6.38%	2.13%
	Create SOP's for harvest and post-harvest activities	51.06%	30.50%	7.09%	11.35%
	Make value-added products	43.26%	34.75%	18.44%	3.55%
Manage Pests	Assess pest pressure/damage	97.40%	1.30%	1.30%	0.00%
	Identify pests (e.g. weeds, disease, insects)	96.75%	2.60%	0.65%	0.00%
	Determine pest control method	94.81%	3.25%	1.30%	0.65%
	Manage weeds appropriately	90.91%	7.79%	1.30%	0.00%
	Apply preventative measures for crops	89.61%	5.84%	3.90%	0.65%
	Implement approved pest control measures	88.96%	8.44%	1.30%	1.30%
	Identify resources available for pest management	86.36%	12.34%	1.30%	0.00%
	Record pest control method	70.13%	24.03%	5.84%	0.00%
	Manage biosecurity	68.18%	23.38%	4.55%	3.90%
Operate Farm Equipment and Machinery	Operate equipment and tools safely and effectively	97.67%	2.33%	0.00%	0.00%
	Select the right tool for the job	93.80%	6.20%	0.00%	0.00%
	Repair tools and equipment	93.02%	6.20%	0.00%	0.78%

	Troubleshoot mechanical problems	89.15%	9.30%	0.78%	0.78%
	Sharpen tools	89.15%	10.08%	0.78%	0.00%
	Operate farm vehicles	87.60%	11.63%	0.78%	0.00%
	Determine short and long-term equipment and tool needs	85.27%	12.40%	0.78%	1.55%
	Clean tools and equipment	82.17%	15.50%	1.55%	0.78%
	Research equipment and tools	80.62%	16.28%	1.55%	1.55%
	Inspect production equipment and facilities	75.19%	22.48%	0.00%	2.33%
	Follow seasonal service protocol	74.42%	23.26%	0.00%	2.33%
	Create SOP's for tools & equipment	44.96%	41.09%	5.43%	8.53%
Manage Farm Infrastructure	Repair infrastructure	94.89%	5.11%	0.00%	0.00%
	Construct infrastructure	89.05%	10.22%	0.00%	0.73%
	Maintain farm infrastructure (e.g. roads, fences, hedgerows)	85.40%	13.14%	0.73%	0.73%
	Conduct basic carpentry	81.75%	16.06%	1.46%	0.73%
	Evaluate infrastructure	79.56%	18.25%	0.73%	1.46%
	Conduct basic plumbing	74.45%	21.90%	2.19%	1.46%
	Conduct basic electrical	64.23%	30.66%	2.19%	2.92%
	Establish preventative maintenance schedule	55.47%	38.69%	5.11%	0.73%
	Demolish unnecessary infrastructure	41.61%	40.15%	13.87%	4.38%
Steward Soil Health	Manage organic matter	95.83%	2.78%	0.69%	0.69%
	Manage soil fertility	95.14%	4.17%	0.00%	0.69%
	Determine soil management based on soil properties	88.89%	8.33%	2.08%	0.69%
	Manage soil water	88.89%	9.03%	0.69%	1.39%

	Identify soil health resources	81.94%	14.58%	1.39%	2.08%
	Execute soil health plan	81.94%	14.58%	0.69%	2.78%
	Manage composting systems	80.56%	13.19%	4.17%	2.08%
	Conduct soil samples	74.31%	20.14%	4.17%	1.39%
	Interpret soil tests	72.22%	22.92%	3.47%	1.39%
	Create soil health plan	69.44%	26.39%	1.39%	2.78%
Manage Water Resources	Manage irrigation needs	96.00%	2.40%	0.80%	0.80%
	Assess irrigation needs	92.80%	4.80%	1.60%	0.80%
	Conserve water resources	88.00%	8.80%	2.40%	0.80%
	Manage drainage	87.20%	12.00%	0.80%	0.00%
	Assess drainage needs	86.40%	12.80%	0.80%	0.00%
	Monitor and maintain water quality	71.20%	23.20%	4.00%	1.60%
	Adhere to local regulations	68.00%	23.20%	8.00%	0.80%
	Create water supply chain plan	52.80%	32.00%	7.20%	8.00%
	Execute water supply chain plan	52.00%	34.40%	5.60%	8.00%
Manage Human Resources	Delegate tasks to staff	97.03%	2.97%	0.00%	0.00%
	Train employees (incl. orientation)	97.03%	2.97%	0.00%	0.00%
	Determine staffing needs	96.04%	2.97%	0.99%	0.00%
	Oversee staff work	93.07%	6.93%	0.00%	0.00%
	Align staff skills with farm needs	92.08%	7.92%	0.00%	0.00%
	Establish employee health & safety protocol	91.09%	7.92%	0.99%	0.00%
	Resolve employee issues/conflict	90.10%	6.93%	1.98%	0.99%
	Recruit job applicants	88.12%	10.89%	0.99%	0.00%
	Solicit staff feedback	87.13%	10.89%	1.98%	0.00%

	Manage WorkSafe BC requirements	85.15%	12.87%	0.99%	0.99%
	Manage Payroll and accounting	85.15%	11.88%	1.98%	0.99%
	Evaluate staff performance	83.17%	14.85%	0.99%	0.99%
	Conduct interviews	78.22%	15.84%	4.95%	0.99%
	Establish employment contracts	69.31%	23.76%	5.94%	0.99%
	Establish communications protocol for staff	69.31%	26.73%	2.97%	0.99%
	Create job descriptions (incl. owners, managers, seasonal staff)	65.35%	25.74%	7.92%	0.99%
	Facilitate staff goal setting	58.42%	32.67%	7.92%	0.99%
	Research worker grants and subsidies	52.48%	32.67%	10.89%	3.96%
	Establish HR / staffing policies (e.g. employee handbook)	49.50%	36.63%	10.89%	2.97%
Manage Farm Business Administration	Manage communications (e.g. emails)	93.23%	5.26%	1.50%	0.00%
	Maintain record keeping systems	90.23%	7.52%	2.26%	0.00%
	Set short and long-term goals	89.47%	9.77%	0.75%	0.00%
	Procure tools, equipment and supplies	89.47%	9.02%	1.50%	0.00%
	Secure access to land (e.g. purchase land, negotiate lease agreements)	85.71%	7.52%	6.02%	0.75%
	Manage farm safety and security	85.71%	13.53%	0.00%	0.75%
	Develop business plan	76.69%	21.05%	2.26%	0.00%
	Obtain necessary licenses, permits and certifications	76.69%	16.54%	5.26%	1.50%
	Order and track inventory	75.94%	21.05%	3.01%	0.00%

	Maintain insurance policies	73.68%	23.31%	2.26%	0.75%
	Establish business legal structure	63.91%	27.07%	8.27%	0.75%
	Identify contractor needs (e.g. bookkeeper, electrician, etc.)	63.91%	26.32%	7.52%	2.26%
	Develop risk management plan	45.86%	39.85%	10.53%	3.76%
	Create farm succession plan	45.86%	36.09%	12.78%	5.26%
	Develop SOPs	45.11%	37.59%	9.02%	8.27%
Manage Farm Finances	Manage overall farm budget	96.95%	0.76%	1.53%	0.76%
	Keep financial records	96.95%	0.76%	1.53%	0.76%
	Pay taxes	93.89%	5.34%	0.76%	0.00%
	Manage bookkeeping systems	90.84%	6.11%	1.53%	1.53%
	Evaluate profitability of enterprises	87.02%	9.16%	2.29%	1.53%
	Manage short and long-term debt	83.97%	12.21%	1.53%	2.29%
	Source funds	70.99%	23.66%	5.34%	0.00%
	Create enterprise budgets	64.89%	25.95%	3.82%	5.34%
Manage Farm Product Marketing and Sales	Manage customer relationships	95.21%	4.11%	0.68%	0.00%
	Communicate with customers	95.21%	3.42%	0.68%	0.68%
	Manage sales accounts	86.30%	8.90%	2.74%	2.05%
	Develop Brand	80.82%	16.44%	1.37%	1.37%
	Handle cash, till, and POS software	80.14%	13.70%	4.11%	2.05%
	Evaluate sales trends	78.77%	18.49%	1.37%	1.37%
	Evaluate marketing needs	77.40%	19.18%	2.05%	1.37%
	Maintain online/social media presence	76.71%	16.44%	4.79%	2.05%
	Create marketing strategy (e.g. 4 P's:	76.71%	17.12%	3.42%	2.74%

	Product, Place, Price, Promotion)				
	Develop marketing materials	75.34%	19.86%	3.42%	1.37%
	Select appropriate marketing technology and tools for target demographic	74.66%	19.18%	3.42%	2.74%
	Conduct market research	61.64%	32.19%	2.74%	3.42%
	Sell at farmers markets	58.90%	24.66%	14.38%	2.05%
Engage in Community	Establish relationships with other farmers, businesses and other organizations	95.54%	2.68%	0.89%	0.89%
	Promote sustainable local farming and food systems security	88.39%	11.61%	0.00%	0.00%
	Patronize local businesses	88.39%	9.82%	0.89%	0.89%
	Maintain friendly relationship with neighbours	87.50%	11.61%	0.89%	0.00%
	Conduct education and outreach activities	68.75%	25.00%	4.46%	1.79%
	Host community events and farm tours	63.39%	28.57%	6.25%	1.79%
	Acknowledge and engage in indigenous community	59.82%	28.57%	8.93%	2.68%
Pursue Professional Development	Learn from experience	98.18%	0.91%	0.00%	0.91%
	Observe farm daily	89.09%	9.09%	0.91%	0.91%
	Visit other farms	86.36%	10.91%	1.82%	0.91%
	Read agricultural literature	83.64%	14.55%	0.91%	0.91%
	Keep posted on current events and trends	82.73%	15.45%	0.91%	0.91%
	Attend classes, conferences, and workshops	79.09%	17.27%	3.64%	0.00%
	Establish relationship with local institutions and organizations	70.91%	27.27%	1.82%	0.00%

	Find a farm mentor	57.27%	31.82%	6.36%	4.55%
	Keep a farm journal	50.00%	42.73%	4.55%	2.73%

Appendix F-4 Write-in Task Statements

Duty	**Write-in tasks**
Manage Livestock Operations	Protect livestock from predators
	Grow supplemental livestock feed (e.g. pasture, hay, grain, etc.)
	Purchase stock
	Breed livestock
	Manage livestock infrastructure (e.g. housing, fencing, watering, feeding systems)
Manage Perennial Crop Production	Create and execute drainage plan
	Design and manage intercropping systems
Manage Vegetable Crop Production	Design and implement irrigation systems
	Design and implement crop rotation plan
Manage Harvest and Post-Harvest Handling of Crops	Manage post-harvest crop storage (e.g. refrigeration, curing, etc.)
	Manage product delivery
	Ensure efficient workflow
	Manage farm product delivery
	Design effective post-harvest processing area
Manage Pests, Weeds, and Diseases	Design and implement an IPM plan
	Use pest control methods that minimize ecological detriment (e.g. beneficials, biological predators, organic products)
	Follow health and safety protocols (e.g. proper PPE and applicator trainings/certifications)
Operate Farm Equipment and Tools	Train employees on equipment and machinery operation
	Store equipment to maximize longevity
Manage Farm Infrastructure	Manage irrigation and drainage infrastructure
	Determine new infrastructure needs
	Research building codes and bylaws
	Develop organizational systems for infrastructure spaces
Steward Soil Health	Increase soil organic matter (via covercropping, crop rotation, nutrient cycling, livestock integration, etc.)
	Manage soils to sequester carbon and reduce GHG emissions

	Produce and/or procure amendments
Manage Water Resources	Maintain irrigation infrastructure
	Plan and execute irrigation schedule
	Prioritize use of renewable water resources (e.g. grey water)
Manage Human Resources	Facilitate professional development for workers
	Manage volunteer/internship program(s)
	Provide a positive work environment for staff (e.g. living wage, adequate housing, etc.)
	Create a staff contingency plan
	Comply with foreign worker standards
Manage Farm Business Administration	Engage in government regulations and programs
Manage Farm Finances	Determine appropriate financing structure
	Manage cash flow
	Manage accounts payables/receivables
	Secure off-farm income (if required)
Develop Farm Marketing and Sales Plan	Manage online sales platforms
	Sell to wholesalers/retailers
	Sell via direct marketing outlets (e.g. CSA, farmgate, farmers markets)
	Determine product prices
	Establish sales networks
	Plan for and execute growth strategy
	Move and store inventory efficiently
Engage in Community	Engage with government (e.g. lobbying, policy, programs)
Pursue Professional Development	Engage in online resources (e.g. tutorials, workshops, publications)
	Participate in industry associations and/or organizations

Appendix F-5 Modified Task Statements

Duty Statement	**Original Task Statement**	**Revised Task Statement**
Manage Livestock Operations	Create and execute waste resource plan (e.g. offal)	Create and execute waste resource plan (e.g. manure, carcasses, offal, etc.)
Manage Perennial Crop Production	Design perennial crop plan (e.g. select root stock, identify crops, succession planting, design systems)	Design perennial crop plan (e.g. select planting stock, identify crops, design systems, succession planting)
Manage Pests	Apply preventative measures for crops	Apply preventative measures for crops (e.g. crop rotation, cultural controls, on-farm biodiversity, habitat for beneficials)
Manage Farm Infrastructure	Construct infrastructure	Construct infrastructure (following building code and bylaws)
Steward Soil Health	Determine soil management based on soil properties	Determine soil management based on soil properties (e.g. soil structure)
	Manage soil fertility	Manage soil fertility (e.g. nutrients, pH, organic matter, C:N ratio)
	Manage soil water	Manage soil water (e.g. availability, drainage, runoff)
Manage Water Resources	Conserve water resources	Conserve water resources (e.g. water sources, riparian areas, waterways, reduce waste, use grey water)
	Manage irrigation needs	design and implement irrigation system
	Assess irrigation needs	Assess irrigation needs (e.g. pressure, flow, volume required)
Manage Farm Finances	Create enterprise budgets	Create, adapt, and/or use enterprise budgets
Engage in Community	Host community events and farm tours	Engage in community events and farm tours (e.g. host, attend, participate in)
Pursue Professional Development	Find a farm mentor	Engage in mentorship opportunities (e.g. intergenerational knowledge transfer)