

**“TAILS” FROM THE FARM: STORIES OF THE SUCCESSES, CHALLENGES AND BARRIERS OF INTEGRATING LIVESTOCK ON CAMPUS FARMS AND GARDENS AT POST-SECONDARY INSTITUTIONS IN CANADA AND THE UNITED STATES**

by

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## ABSTRACT

This thesis examines the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States based on my experience in integrating livestock at the University of British Columbia Farm (Phase I), and the experiences of representatives from other campus farms and gardens that are currently integrating, had integrated, and/or are wanting to integrate livestock (Phase II – Parts 1 and 2). The research methodology in Phase II was guided by the qualitative description approach, with foundational elements of pragmatism and participatory paradigms. Participants were sought via an online survey (Part 1) that was sent to 144 known campus farms and gardens and to the Sustainable Agriculture Education Association (SAEA) listserv. Of the 28 participants that responded to the survey, 22 consented to participate in in-depth, semi-structured interviews (Part 2), which were transcribed and analyzed using qualitative content analysis.

Based on the results, the integration of livestock fulfilled the missions of all campus farms and gardens in Phases I and II by providing experiential learning, skill building and engagement opportunities for students, and public demonstrations of alternative livestock production methods (social successes). It also provided many with ecological services, such as nutrient cycling and pest management (ecological successes), and economic diversification and additional revenue (economic successes).

Despite the wide array of challenges and barriers due to their applicability to, and the uniqueness of campus farms and gardens, the barriers encountered by campus farms and gardens that are wanting to integrate livestock were also the challenges experienced by those that are integrating (or had integrated) livestock. A comparison of the most frequently cited challenges and barriers revealed four common responses: *Labour and Logistics, Institutional System and*

*Support, Animal Ethics Committees, and Space and/or Infrastructure* (three of which I experienced in Phase I). I argue that addressing these four challenges/barriers will help to facilitate livestock integration on a majority of campus farms and gardens, and possibly resolve some of the other challenges and barriers connected with them; thereby allowing campus farms and gardens to reap the successes of livestock integration – particularly the social successes.

## LAY SUMMARY

This thesis examines the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States based on my experience at the University of British Columbia Farm, and the experiences of representatives that are currently integrating, had integrated, and/or are wanting to integrate livestock on their sites.

Based on the results, the integration of livestock fulfilled the missions of all campus farms and gardens by providing educational and engagement opportunities for students and the public (social successes). It also provided many sites with ecological and economic benefits (ecological and economic successes).

There were many similarities among the challenges and barriers, but the most common were *Labour and Logistics, Institutional System and Support, Animal Ethics Committees, and Space and/or Infrastructure*. I argue that addressing these will help campus farms and gardens to reap the successes of livestock integration – particularly the social successes.

## **PREFACE**

This thesis is original, unpublished, independent work by the author, Natalie B. A. Yuen. The research in Phase I was approved by the UBC Animal Care Committee, file #A11-0034. The research in Phase II (Parts 1 and 2) was approved by the UBC Behavioural Research Ethics Board, file #H16-01759. Any future publications of the findings in this thesis will be prepared by the author.

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To 婆婆  
(my grandmother)

I dedicate this thesis to my late grandmother,  
whose love during her life and beyond this earthly life  
have brought me to where I am today.

# **CHAPTER 1: INTRODUCTION**

## **PERSONAL JOURNEY TOWARDS THIS STUDY**

My story began with a simple goal: find a career that would allow me to work with animals. I had been working as a veterinary assistant since graduating from the University of British Columbia (UBC) in 2004, and I wanted to turn my passion and experience into a long-term career. So, after four years of treating pets of all species and sizes, assisting in many surgical and diagnostic procedures, and administering medications to my (sometimes uncooperative) patients, I enrolled as a student in the Faculty of Land and Food Systems (LFS) at UBC to become a veterinarian.

Before my first day of classes in September 2008, I was warned by friends who had gone through the LFS pre-veterinary program that I would be required to take pre-requisite courses in agriculture and sustainable food systems. Having been born and raised in major cities and given that I had never set foot on a farm in my life, it would not be hard to imagine how nervous I was about this. I became increasingly concerned that these pre-requisite courses would somehow stop me from becoming a veterinarian. Looking back, my concerns were not unfounded. These courses did stop me from becoming a veterinarian, but more importantly, they set me on an unexpected and extraordinary journey that not only shaped my academic career, but also led me to where I am today.

One of the first pre-requisite courses I took was Agroecology 260 (now Applied Biology 260) taught at the time by Dr. Art Bomke. A major component of this course involved working on a project at the UBC Farm – a 24-hectare, certified organic campus farm at the Centre for Sustainable Food Systems (CSFS) at UBC's Vancouver campus. My project was a hypothetical

feasibility study determining whether the UBC Farm should consider integrating goats or pigs into its agroecosystem<sup>1</sup>, in addition to the laying hens already integrated on site. After completing the project, I was so inspired by the UBC Farm and the concept of raising livestock using alternative, agroecological approaches and methods. I wanted to learn more.

Shortly thereafter, Art approached me with an opportunity to temporarily integrate cattle at the UBC Farm through a partnership with Harold Steves, a farmer and City Councillor who owns and operates a Belted Galloway beef cattle farm. I immediately jumped at the chance and spent the next six months volunteering at Harold's farm, learning everything I could about raising beef cattle from Harold's wealth of knowledge and experience, and from the research and literature available. In the spring of 2010, I launched a 3-month pilot project, bringing two Belted Galloways to the UBC Farm to graze in a spare field outside of the main 8-year crop rotation. Within this field, I created a small-scale rotational grazing system which involves dividing the land into smaller sections called paddocks with fencing (usually electric), and allowing the cattle to graze sequentially through the paddocks (Beetz & Reinhart, 2010). Once a paddock has been grazed, it is fenced off to allow the forage to rest and regrow (Beetz & Reinhart, 2010). These rotational grazing systems allow farmers to manage and control grazing (thereby reducing selective grazing, which cattle are known for), and to maximize their forage resources (Beetz & Reinhart, 2010).

My first learning objective was to experience the intricacies of integrating a new livestock species into an existing agroecosystem – i.e. working with the cattle, building/setting up the necessary infrastructure, designing and implementing a rotational grazing system, etc. My second learning objective was to demonstrate an alternative method of raising cattle on a small-

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<sup>1</sup> An agroecosystem is defined as an agricultural system that functions and operates holistically as an ecosystem (Gliessman, 2007).

scale, campus farm based on agroecological principles. I knew this project was going to involve a great deal of work, especially for a self-proclaimed “city kid”, but what I did not anticipate was the number of challenges I experienced in integrating livestock at the UBC Farm. However, in spite of these challenges, I was still able to see the project through to completion and met both of my learning objectives.

Following the pilot project’s success, I wanted to take the concept of livestock integration a step further by integrating two livestock species at the UBC Farm, specifically into the main 8-year crop rotation, which, at the time, had not been done before. And so, in the spring of 2011, as Phase I of this Master’s thesis (discussed in Chapter 2), I integrated two of Harold’s Belted Galloways along with a flock of seventeen Agassiz X laying hens in one of the UBC Farm’s main crop rotation fields, and implemented a multi-livestock species rotational grazing system, similar to one popularized by Virginia farmer and author, Joel Salatin. Unfortunately, like the previous year, Phase I was not without its challenges. But along with these challenges, I also experienced a number of successes which would not have been possible without the real-world, hands-on experiential learning opportunity that I was afforded at the UBC Farm. Moreover, in hindsight, the challenges that I experienced could have potentially become barriers preventing me from integrating livestock at the UBC Farm.

As I reflected on my experiences, several questions came to mind. Were the successes and challenges I experienced typical of campus farms and gardens at other post-secondary institutions that have integrated livestock? Were the successes and challenges I experienced specific to my project at the UBC Farm? Are there successes and challenges of integrating livestock that I did not experience, but that are experienced by other campus farms and gardens?

What about campus farms and gardens that have encountered barriers preventing them from integrating livestock altogether?

## **STATEMENT OF RESEARCH PROBLEM & PURPOSE**

In recent years, the number of campus farms and gardens at post-secondary institutions, particularly in the United States, have increased; and while there is a growing body of literature with respect to campus farms and gardens and their educational value at post-secondary institutions, research about the integration and roles of livestock on these sites is lacking (Leis, Whittington, Bennett & Kleinhenz, 2011; Sayre & Clark, 2011). Because of this and my experience in integrating livestock at the UBC Farm, it is here where my research begins.

The purpose of this research, therefore, was to determine and discuss the successes, challenges and barriers of integrating livestock<sup>2</sup> on campus farms and gardens at post-secondary institutions in Canada and the United States. My research questions were as follows:

1. What are the successes and challenges of integrating livestock at the UBC Farm that I experienced (Phase I)?
2. What are the successes, challenges and barriers of integrating or wanting to integrate livestock that campus farms and gardens at post-secondary institutions in Canada and the United States are experiencing (Phase II)?
3. What are the similarities and differences between my experience (Phase I) and the experiences collected (Phase II)?
4. How can this knowledge help to address some of the challenges and barriers that campus farms and gardens at post-secondary institutions in Canada and the United States are

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<sup>2</sup> In this study, the term “livestock” is defined as any animal that is kept and raised for agricultural and/or food production purposes (i.e. cattle, chickens, horses, pigs, goats, sheep, turkeys, rabbits, geese, etc.).



experiencing or encountering (respectively) in integrating or wanting to integrate livestock on their sites?

### ***Defining Successes, Challenges and Barriers of Integrating Livestock***

Given these research questions, it was necessary to define successes, challenges and barriers in terms of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States. For the intents and purposes of this study, I defined challenges as anything that poses some form of opposition to (but that does not prevent) the integration of livestock on campus farms and gardens, whereas I defined barriers as anything that prevents or inhibits the integration of livestock. Defining successes, on the other hand, proved to be more difficult.

In my preliminary research, I found several lists of campus farms and gardens at post-secondary institutions in Canada and the United States from online and in print sources. These lists were not exhaustive and many were incomplete, so I compiled them into one spreadsheet listing basic identifying information about each campus farm or garden (e.g. the name of its post-secondary institution, its geographic location, etc.) and general crop and/or livestock production information that I found on their respective websites and/or Facebook pages. As I was gathering this information, it became apparent that no two campus farms or gardens are the same. For instance, some are run by students of the post-secondary institution, while others are run by paid (non-student) staff; and some are large farms with multiple production fields, while others are small gardens with raised beds. So, how could the successes of integrating livestock be defined if campus farms and gardens are inherently different?

The word “success” is defined as “the accomplishment of an aim or purpose” and although campus farms and gardens are different, one feature they do share is that they are driven by an aim or purpose, or more specifically, by their own mission statements (Success, 2017). Thus, for this study, successes were defined as to whether integrating livestock satisfied or fulfilled the mission of a campus farm or garden.

## **THESIS OVERVIEW**

This thesis consists of five chapters. Chapter 2 is divided into two sections: the first provides an overview of the available literature on the integration of livestock in agricultural systems and places this study within that context; and the second discusses the successes and challenges of integrating livestock at the UBC Farm that I experienced in Phase I. Chapter 3 outlines the paradigms that guided my methodological approach to qualitative inquiry and the rationale for the methods I chose for collecting and analyzing the data in Phase II. The results of Phase II are presented, discussed and compared to the results of Phase I in Chapter 4. Finally, in Chapter 5, the main findings are summarized, and recommendations and directions for future research are provided.

## **CHAPTER 2: LITERATURE REVIEW AND INTEGRATING LIVESTOCK AT THE UBC FARM (PHASE I)**

### **INTRODUCTION**

The first part of this chapter reviews the literature on the movement towards an agroecological approach to agriculture, the role of livestock in these systems, and how this movement has influenced the post-secondary education system. The second part of this chapter describes the results of Phase I: my experience in integrating beef cattle and laying hens at the UBC Farm in 2011, and the project's successes and challenges. For the sake of brevity, the term "campus farms and gardens" will be used hereafter to refer to campus farms and gardens at post-secondary institutions in Canada and the United States, unless otherwise specified.

### **LITERATURE REVIEW**

#### *The Reintegration of Livestock into Agricultural Systems*

In response to the industrialization and centralization of agriculture, there has been a movement towards an alternative approach where agricultural systems are viewed holistically as functioning ecosystems (or agroecosystems), and agricultural practices are more ecologically focused to increase the stability and sustainability of the system as a whole (Altieri, 1987; Dumont, Fortun-Lamothe, Jouven, Thomas & Tichit, 2013; Gliessman, 2007). With this movement, there has been a resurgence of the pastoral, crop-livestock farming systems that once dominated the agricultural landscape, where livestock are being integrated (or reintegrated) into these agroecosystems in one of three ways (Gliessman, 2007; Hilimire, 2011; Lang & Heasman, 2004; Russelle, Entz & Franzluebbbers, 2007). The first involves a spatial separation between crop and livestock production, where livestock are maintained in one area of a farm (i.e.

permanent pastures, barns, etc.) and forage and/or supplemental feed crops are grown in another area (Hilimire, 2011). In contrast, the second way involves fully incorporating crop and livestock production, where livestock graze or forage in the same area where crops are grown or were recently harvested (Hilimire, 2011). Finally, the third way involves a temporal separation between crop and livestock production, where livestock and crops are rotated so that they are not in the same area at the same time (Hilimire, 2011). Regardless of the way in which livestock are integrated, these agroecosystems decentralize livestock production and take advantage of the natural synergies and ecological relationships between animals and plants at the trophic level, resulting in more ecologically, economically and socially sustainable systems (Clark, 2004; Gliessman, 2007).

From an ecological standpoint, livestock-integrated agroecosystems are more diverse, ecologically stable and resilient (Franzluebbers, 2007; Gliessman, 2007; Hilimire, 2011). Livestock consume plant biomass in the form of feed, forage crops and/or crop residues, and convert it into many usable forms, such as: 1) protein-rich animal biomass for human consumption (i.e. meat, eggs, milk, etc.); 2) manure, allowing nutrients within the manure to return or be deposited into the soil via nutrient cycling thereby keeping the flow of nutrients within the agroecosystem; and 3) energy for the animal to function physiologically and/or to perform work on a farm (Dumont *et al.*, 2013; Gliessman, 2007; Hilimire, 2011; van Keulen & Schiere, 2004). Also, livestock-integrated agroecosystems increase the health and productivity of crops, improve soil health by increasing organic matter and soil microbial activity; improve soil quality through nitrogen fixation; and aid in other ecological services, such as the management of pests, weeds and other vegetation (Clark, 2004; Dumont *et al.*, 2013; Franzluebbers, 2007; Hilimire, 2011; Russelle *et al.*, 2007; van Keulen & Schiere, 2004).

As for economic advantages, integrating livestock into agroecosystems reduces (and can possibly eliminate) the need to purchase and apply external inputs, such as soil amendments and fertilizers; increases crop yields in crop rotations; improves land use efficiency by allowing farmers to layer their crop and livestock enterprises and generate more income per area of land; and improves the economic diversity and financial stability of farmers, especially those in developing countries, through the sale of value-added animal-based food products (Dumont *et al.*, 2013; Entz, Bullied & Katepa-Mupondwa, 1995; Gliessman, 2007; Hilimire, 2011; van Keulen & Schiere, 2004).

Finally, with regards to social sustainability, livestock-integrated agroecosystems strengthen the relationships between farmers and their local communities through the provision of diverse and more calorically-dense foods (i.e. animal-based food products), and promotes and enhances the localism of food production and consumption (Gliessman, 2007; Hilimire, 2011). It could also be argued that integrating livestock into agroecosystems is socially advantageous for the animals as it allows them the opportunity and choice to perform physiologically inherent or “natural” behaviours (i.e. grazing, dust bathing, etc.) in more natural environments. This concept of “naturalness” or natural living is one of the three criteria of animal welfare – the other two being the basic biological health and functioning of the animal, and the freedom from negative states that inflict long-term suffering to the animal (Fraser, 2008).

Yet despite these ecological, economic and social advantages, integrating livestock into agroecosystems also has several disadvantages (Franzluebbbers, 2007; Hilimire, 2011; van Keulen & Schiere, 2004). One of the main disadvantages is the additional knowledge, management and labour required to raise livestock (Dumont *et al.*, 2013; Franzluebbbers, 2007; Hilimire, 2011; van Keulen & Schiere, 2004). Working with livestock requires specialized knowledge/experience,

skills and training, and this, coupled with the complexities of integrating them with crop production and having to balance the competing demands of crop and livestock production during busy growing seasons results in more management and labour (Franzluebbbers, 2007; Hilimire, 2011). Farmers also need to consider other management factors, such as the regulations and restrictions related to the timing of when crops can be planted in a field that has had raw manure from livestock deposited in it, and the lack of and/or costs associated with local, small-scale livestock processing facilities (Franzluebbbers, 2007; Hilimire, 2011). Other disadvantages of integrating livestock into agroecosystems include: the increased capital and infrastructure costs to house livestock; the lower economies of scale due to managing and marketing multiple on-farm enterprises; possible crop damage and soil compaction due to improper management of livestock grazing and foraging; and possible concerns over the safety (predation risk) and health of livestock in more natural environments, especially if breeds selected for integration are those that have been bred for production and are less physiologically resilient to disease or pathogen pressure from the environment (Balcolm, Reeves, Kemble, Dawkins & Raper, 2011; Franzluebbbers, 2007; Hilimire, 2011; van Keulen & Schiere, 2004).

### ***The Agroecological Movement in the Post-Secondary Education System***

This movement towards an agroecological approach to crop and livestock production has also been seen within the post-secondary education system. Growing demand and interest from students (from rural and, more commonly, urban backgrounds) wanting to know how their food is produced and the environmental, societal and human health implications of these production methods have led to the increase in the number of campus farms and gardens in recent years, as mentioned in Chapter 1 (Leis *et al.*, 2011; Reeve, Hall & Kalkman, 2014; Sayre & Clark, 2011;

Trede & Andreasen, 2000). Some campus farms and gardens are integrating livestock into their agroecosystems, while others are not. A possible and seemingly straightforward explanation for this may be that integrating livestock on campus farms and gardens is a matter of choice or preference, but perhaps there is more to it than that.

Integrating livestock on campus farms and gardens can provide the same ecological, economic and social advantages and disadvantages as previously discussed. However, indicators of social sustainability, compared to those of ecological and economic sustainability, are more subjective and dependent on the system under observation (Gliessman, 2007). Therefore, it is also important to consider other social advantages and disadvantages of integrating livestock on campus farms and gardens that stem from their affiliation with post-secondary institutions.

According to recent studies, campus farms and gardens serve as optimal sites for experiential learning in agricultural education (Parr & Trexler, 2011; Parr & Van Horn, 2006; Reeve *et al.*, 2014). Experiential learning is a form of applied learning or “learning by doing” and has shown to be more effective than traditional learning methods alone, such as the dissemination of information through teacher-centric classroom instruction or through the reading of printed or online material (Baker, Robinson, & Kolb, 2012; Reeve *et al.*, 2014; Schwartzman & Henry, 2009). Parr and Trexler (2011) reported on post-secondary students’ perspectives regarding effective learning approaches in agricultural education and their experiences and motivations for participating and/or working on campus farms and gardens. The results showed that students prefer traditional learning to be integrated and balanced with experiential learning opportunities, and that students were intrinsically motivated and felt a sense of purpose to participate or work on campus farms and gardens (Parr & Trexler, 2011). Students saw their campus farms and gardens as places where they could learn and develop interpersonal

and community building skills, where their education could align with their personal ideals and values, and “where they could pursue more applied, active, and interest-relevant learning” (Parr & Trexler, 2011, p. 178). Experiential learning has also been found to be an effective teaching tool for students in animal agriculture, allowing them to understand and apply animal science concepts in the context of a real-world setting and to learn proper animal husbandry skills (Reiling, Marshall, Brendemuhl, McQuagge & Umphrey, 2003). Based on these findings, integrating livestock on campus farms and gardens might be socially advantageous in that it may serve to enhance and/or provide more experiential learning opportunities for students who are interested in animals and animal husbandry, and/or who are studying animal science or agriculture. It may also attract more students to campus farms and gardens (and to their respective post-secondary institutions), particularly students who may not be involved with their campus farms and gardens otherwise (Leis *et al.*, 2011).

Livestock integration on campus farms and gardens may also provide educational and engagement opportunities for the local community. In a survey of urban livestock owners in the United States, some cited community building and educational benefits of integrating livestock on their properties (McClintock, Pallana & Wooten, 2013). The same benefits could also be provided to local communities near campus farms and gardens given their locations in, or close proximity to urban, residential areas. However, this very fact may also contribute to some of the potential social disadvantages of livestock integration. One such disadvantage may be that instead of building community, integrating livestock on campus farms and gardens may upset the local community. Noise, odor and aesthetic complaints from residential neighbours, as seen in the literature on urban livestock integration, can create tensions between campus farms and gardens and community members (Schindler, 2012). Another social disadvantage may be that



integrating livestock could compound the operational difficulties that some campus farms and gardens are already facing on a daily basis, such as securing a constant source of funding; dealing with institutional bureaucracy, student turnover, and changes in students' schedules; and the lack of administrative and institutional support (Leis *et al.*, 2011; Ratasky, Schroeder-Moreno, Jayaratne, Bradley, Grossman & Orr, 2015).

Having discussed and extrapolated possible ecological, economic, and social advantages and disadvantages of integrating livestock on campus farms and gardens, and given the lack of published literature on this topic, one can certainly say that a knowledge gap exists. This study was an attempt at filling this gap.

## **PHASE I: INTEGRATING LIVESTOCK AT THE UBC FARM**

### ***Characterizing the UBC Farm as a System***

In order to contextualize my experience in integrating livestock at the UBC Farm and the project's successes and challenges, I must begin by characterizing the UBC Farm as a system, which Spedding (1988, p. 18) defines as "...a group of interacting components, operating together for a common purpose, ...[that] has a specified boundary based on the inclusion of all significant feedback". To accomplish this, I have chosen to use a systems analysis.

A systems analysis is a holistic method of studying systems that involves breaking them down into four main categories to understand how they operate as a whole (Bomke, Rojas & Skura, 2008; Spedding, 1988; Tow, Cooper, Partridge, Birch & Harrington, 2011). The first category is the goals or objectives of the system that direct its overall function and purpose (Bomke *et al.*, 2008; Tow *et al.*, 2011). The second category is the boundaries within which the system operates – i.e. the physical boundaries that limit a system spatially and delineate what is

part of the system and what is not, and the perceptual boundaries that restrict and regulate the system's functions (Bomke *et al.*, 2008; Tow *et al.*, 2011). The system's components compose the third category, and these are the biological/physical and socio-economic parts of the system that, if added, removed or changed, influence or impact the system in some way (Bomke *et al.*, 2008; Tow *et al.*, 2011). The fourth category is the interactions, or more specifically, the relationships between the boundaries and components of the system, and between the components themselves (Bomke *et al.*, 2008; Tow *et al.*, 2011).

Performing a systems analysis can be difficult as systems tend to be complex (Spedding, 1988; Tow *et al.*, 2011). The UBC Farm, like all campus farms and gardens, has specific goals, boundaries, components and interactions associated with its institutional affiliation with UBC as an academic unit, as well as its operations as an agroecosystem within which all land use decisions with regards to crop and livestock production are made. This institutional and agroecological duality poses a challenge. One way to approach the issue is to view the UBC Farm as two separate entities – as an academic unit of UBC and as a crop-livestock production-based agroecosystem – and to break down its goals, boundaries, components and interactions from each of those perspectives. While doing so would satisfy the definition of a systems analysis, I would argue that it fails to recognize an inherent and defining characteristic of the UBC Farm (and of all campus farms and gardens, for that matter), and in turn, also fails to provide the proper context required to study it. Therefore, I chose to view the UBC Farm holistically as both an academic unit of UBC, and as a functioning, productive agroecosystem. I also chose to perform the systems analysis of the UBC Farm as it was in the spring of 2011 and from the perspective of integrating the cattle and the chickens (where appropriate) to provide the necessary context for my experience and for the project's successes and challenges.

## *A Systems Analysis of the UBC Farm*

### *1. Goals:*

In 2011, the UBC Farm was guided by an academic plan known as *Cultivating Place*. At the heart of this plan was the Farm's mission statement: "To enable UBC to be a global leader in the creation of new patterns for sustainable and healthy communities integrated with their surrounding ecology, through exemplary, academically rigorous research, through transformative learning, through innovative cross-faculty and interdisciplinary collaboration, through socially responsible community engagement, and through international dialogue and knowledge dissemination." (The Centre for Sustainable Food Systems at UBC Farm – Guiding Principles: *Cultivating Place* [CSFS], 2009). This mission statement was implemented via four main goal areas: *Integration; Teaching and Learning; Research, Discovery and Partnerships*; and *Application* (CSFS, 2009). With *Integration*, the UBC Farm was tasked with promoting interdisciplinary and trans-academic activities that allowed for knowledge of sustainable ecosystems and human health from multiple academic fields, cultures and communities to be created, discussed, tested and disseminated (CSFS, 2009). The UBC Farm was also tasked with providing all students and community learners with knowledge through a wide range of unique, interactive and diverse experiential learning opportunities and using innovative teaching techniques in a "living outdoor classroom" environment through *Teaching and Learning* (CSFS, 2009, p. 6). Coupled with this, *Research, Discovery and Partnerships* facilitated research by providing field space, support and resources for researchers to advance knowledge in all areas of sustainable food systems and to link their research findings with issues that are currently impacting the world; created partnerships and worked collaboratively with public and private sector organizations, cultural and community groups, and government agencies; and engaged the

public through Community Service Learning and/or Community-Based Action Research Initiatives (CSFS, 2009). The fourth goal area, *Application*, involved incorporating and applying the knowledge and experience gained from the integration of teaching, student and community learning, and research discoveries and partnerships into the UBC Farm's day-to-day operations and into the sustainable stewardship and management of the UBC Farm land (CSFS, 2009).

## **2. Boundaries:**

The UBC Farm's physical boundary was its land area, encompassing 24 hectares of UBC Vancouver's South Campus – approximately 12 hectares comprised the Farm's production fields and community program gardens, along with greenspaces, roadways and buildings; and the remaining 12 hectares was the surrounding forest. The main production fields were subdivided into eight fields that composed the Farm's main 8-year crop rotation. In this rotation, seven of the fields were involved in annual crop production, and the remaining field was sown with an overwintering cover crop. In 2011, this cover cropped field (i.e. Field D3-1) was the main site for the project, and measured approximately 121 m by 19.3 m.

The UBC Farm's affiliation with the University was its primary perceptual boundary. As an academic unit of UBC, the UBC Farm's day-to-day operations and management decisions were driven by its educational mission, and as a result, permission from the University was required before the Farm could implement any major programmatic or on-site changes. Related to the integration of livestock, the UBC Farm was perceptually bound by the UBC Animal Care Committee (ACC). The ACC oversees all teaching and research involving animals at the University and reviews animal use protocols to ensure that they abide by the mandatory guidelines issued by the Canadian Council on Animal Care (CCAC) – an organization that

develops and implements high standards of animal care and ethics in science across Canada. The questions on the ACC protocol application require researchers to provide specific details, such as the objectives of the research project, the types of procedures that will be performed on the animals, the level of invasiveness or the degree of impact of the research on the animals, the types of drugs or chemicals that will be used, the justification of the type and number of animals required for the research project, the experimental and/or humane endpoints, and so on. If protocols submitted do not meet the guidelines, they are sent back to the researchers to make revisions and amendments, and the protocols need to be resubmitted to the ACC for additional reviews until final approval is received.

Financial limitations served as another perceptual boundary. I did not have access to research or grant funding to finance this project, so I organized a small fundraiser in partnership with a local bookstore in Vancouver, the UBC Farm and LFS. The UBC Farm also contributed financially by allocating a portion of its small operating budget to help pay for some of the project materials and supplies.

Finally, labour was a perceptual boundary. Since I could not afford to hire a research assistant, the UBC Farm assigned one of its staff members to assist me (part-time) with the daily management and care of the cattle and chickens, and the Farm's caretakers helped on Sundays when the Farm was closed. I also had additional assistance from two groups of UBC undergraduate students (discussed later in this chapter) who helped with some of the initial field and shelter preparations.

### 3. Components

COMPONENT CATEGORY	COMPONENT SUB-CATEGORY	COMPONENT	
BIOLOGICAL/ PHYSICAL COMPONENTS	PHYSICAL SITE	Soil Type	<ul style="list-style-type: none"> <li>• Bose, sandy loam; developed in glacial till, rocky, low water holding capacity</li> </ul>
		Weather	<ul style="list-style-type: none"> <li>• Maritime; unusually warm and dry</li> </ul>
		Infrastructure	<ul style="list-style-type: none"> <li>• Cattle shelter</li> <li>• Mobile chicken shelter</li> <li>• Electric fencing</li> </ul>
	CROPS	Cover Crops	<ul style="list-style-type: none"> <li>• Italian ryegrass (primary)</li> <li>• Crimson clover</li> <li>• Ladino white clover</li> </ul>
	ANIMALS	Livestock	<ul style="list-style-type: none"> <li>• 2 Cattle (Belted Galloways)</li> <li>• 17 Chickens (Agassiz X laying hens)</li> </ul>
		Predators	<ul style="list-style-type: none"> <li>• Coyotes</li> <li>• Raptors (red-tailed hawks, Cooper’s hawks, bald eagles, barred owls)</li> </ul>
SOCIO- ECONOMIC COMPONENTS	FINANCES	Revenue	<ul style="list-style-type: none"> <li>• Fundraiser</li> <li>• Small portion of UBC Farm operating budget</li> </ul>
	LABOUR	Paid Labour	<ul style="list-style-type: none"> <li>• 1 UBC Farm staff member (part-time)</li> <li>• UBC Farm caretakers (on Sundays)</li> </ul>
		Unpaid Labour	<ul style="list-style-type: none"> <li>• Myself</li> <li>• 6 Applied Biology students</li> <li>• 7 Civil Engineering students</li> </ul>
	PUBLIC ENGAGEMENT	Student Engagement	<ul style="list-style-type: none"> <li>• Experiential learning opportunities</li> <li>• Engagement for students with diverse academic and personal interests</li> </ul>
		Community Engagement	<ul style="list-style-type: none"> <li>• Real-world demonstration of an alternative method of livestock production</li> <li>• Community partnerships (Harold Steves)</li> </ul>

**Table 2.1:** Main components of the UBC Farm system in Phase I.

### 4. Interactions:

BOUNDARY	COMPONENT	INTERACTIONS
Area of Field D3-1	All Components	The physical boundary of Field D3-1 forms the basis for the inclusion of all of the system’s components.
Academic Unit of UBC	All Components	Being an academic unit of UBC forms the basis for the inclusion of all of the system’s components.
UBC Animal Care Committee	Livestock	Approval of the ACC was required prior to the integration of the cattle and chickens at the UBC Farm.
Finances	Infrastructure, Livestock and Labour	The project’s main expenses (i.e. infrastructure, paid labour and livestock) were limited by the funds available.
Labour (All)	Infrastructure, Cover Crops and Livestock	The project’s operations (i.e. setting up the infrastructure and the management of the cover crops and livestock) were limited by the available paid and unpaid labour.

**Table 2.2:** Key boundary-component interactions of the UBC Farm system in Phase I.

COMPONENTS		INTERACTIONS
<b>Weather</b>	<b>Cover Crops</b>	The unusually warm and dry weather caused the forage in Field D3-1 to grow faster than expected.
<b>Cattle</b>	<b>Chickens</b>	The cattle grazed the cover crops and the chickens followed consuming the newer, more tender and palatable leaf blades on the plant sheath. The chickens pecked and scratched through the cattle manure looking for and consuming fly larvae.
<b>Livestock (Cattle and Chickens)</b>	<b>Soil</b>	The cattle and chickens aided in nutrient cycling, and increasing soil organic matter and soil microbial activity, as described in the literature review (Dumont <i>et al.</i> , 2013; Gliessman, 2007; van Keulen & Schiere, 2004).
	<b>Cover Crops</b>	The cover crop served as a primary feed source for the cattle and as a secondary/supplemental feed source for the chickens.
	<b>Predators</b>	The predators at the UBC Farm were not necessarily a threat for the cattle due to the size differential, but were for the chickens. Regardless, the ACC required appropriate electric fencing for both species to be installed.
	<b>Labour (All)</b>	Paid and unpaid labour were involved in the preparations for and management of the cattle and chickens.
	<b>Student Engagement</b>	The cattle and chickens engaged students, like myself, with diverse academic and personal interests, and afforded myself and the Civil Engineering and Applied Biology students with multiple experiential learning opportunities.
	<b>Community Engagement</b>	The cattle and chickens were a popular stop on guided tours of the UBC Farm and engaged the community through a demonstration of an alternative method of livestock production.

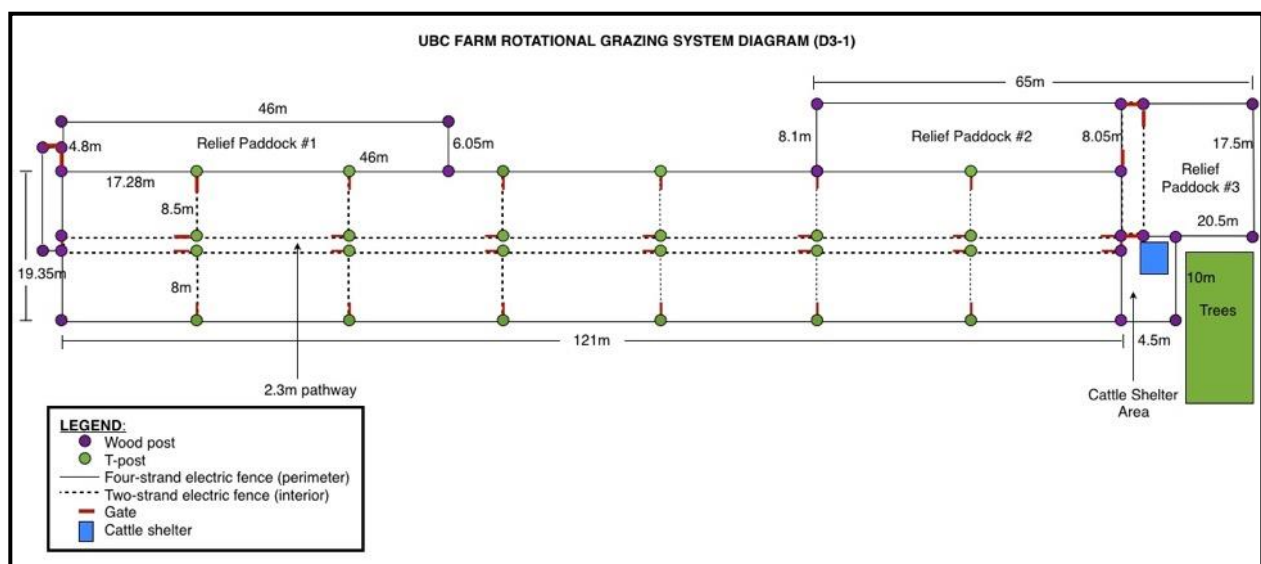
**Table 2.3:** Key component-component interactions of the UBC Farm system in Phase I.

***Project Preparations and Implementation***

Preparations for Phase I began with submitting a protocol application to the ACC, training with the two Belted Galloways that were selected for this project at Harold Steves’ farm, and planning the multi-livestock species rotational grazing system within Field D3-1.

The rationale for using a ruminant (cattle) and a bird species (chickens) together in a rotation stems from an emulation of the symbiotic relationships between large wild ungulates and birds in natural ecological systems (Pollan, 2006). Ungulates graze an area of land, leaving behind their manure which attracts flying insects. These insects lay their eggs in the manure, and wild birds peck and scratch through it searching for and consuming insect larvae. This process benefits both species as it provides the birds with an additional food source, while controlling and reducing the insect populations commonly found around ungulates (Pollan, 2006). In Joel

Salatin's rotation, he subdivides his pasture into paddocks allowing the cattle to graze in one paddock each day; and after three to four days, which allows adequate time for insects to lay their eggs in the cattle manure and for the eggs to mature to the larval (or maggot) stage, the chickens follow the cattle in the rotation (Cornell University, 2016; Gliessman, 2007; Pollan, 2006; Salatin, 2010). Like the wild birds that follow ungulates in natural ecosystems, the chickens peck and scratch through the cattle manure consuming fly larvae and other organisms that may be present, thereby controlling insect populations around cattle and reducing the likelihood of parasitic infestation and disease (Pollan, 2006). Using Salatin's system as a model, I designed a rotational grazing system within Field D3-1.



**Figure 2.1:** Rotational grazing system design in Field D3-1.

I began by installing the electric fence around the perimeter of Field D3-1 (see Figures 2.1 and 2.2) with a group of Applied Biology students who were assisting me to complete their course-required Community Service Learning hours. Factoring in the BC SPCA and Canadian organic production standards for outdoor space and size requirements for beef cattle and laying hens, I subdivided the field into fourteen paddocks (each measuring 17.28 m by 8.5 m) using electric fencing with a 2.3 m pathway down the centre length of the field so the cattle could



move from their designated paddock to the shelter area at will. In addition to the main grazing paddocks, I also fenced off three areas around the perimeter of Field D3-1 (called “relief paddocks”) to serve as additional forage resources in case the cover crops within one of the fourteen paddocks required more time for regrowth. Relief paddocks varied in size and were accessible via designated pathways that extended from the shelter area. Gates leading into Field D3-1 and into the main and relief paddocks were installed and are represented by the small red rectangles in Figure 2.1. The chickens required additional fencing to deter predators (mainly coyotes) and to prevent them from wandering outside of their designated paddock. For this, I installed a removable electric net fence along the interior perimeter of their paddock in the rotation.



**Figure 2.2:** Electric fence preparations in Field D3-1.

The cattle’s shelter, which was the same structure used in the 3-month pilot project in 2010, was a 2.4 m by 1.8 m by 1.8 m structure, constructed using a 6 cm metal, square pipe frame as the base, with corrugated metal sheets around the exterior and a plywood-walled interior. For the chickens, I worked with a group of Civil Engineering students who were tasked with designing and constructing a mobile chicken shelter for this project. Unfortunately, it was not useable because it ended up being too heavy to be moved by one person, especially on the UBC Farm’s sandy soil. So, I worked with a UBC Farm staff member to design and build a more lightweight, mobile chicken shelter using PVC pipes, plywood, chicken wire and a large

tarp. The dimensions of both shelters, including the roosting areas and nest boxes in the chicken shelter, satisfied the BC SPCA and Canadian organic production standards (Figure 2.3).



**Figure 2.3:** The cattle shelter (left) and the PVC mobile chicken shelter (centre and right).

With field preparations for the cattle and the chickens complete, all that remained was the approval of the ACC protocol application, which I was hoping would be expedited as I went through the same application process the year before. And although it was slightly more straightforward, I was required by the ACC to address some provisos and to resubmit the application, which delayed the start of the project. When I finally received ACC approval, I contacted Harold to arrange for the cattle to be transported to the UBC Farm, but the livestock trailer that Harold needed to borrow was not available right away, which caused an additional delay. Furthermore, the chickens' arrival was also delayed due to unforeseen issues with the UBC Farm's supplier.

While awaiting the arrival of the cattle and chickens, the cover crops in Field D3-1 started to go to seed due to the uncharacteristically warm and dry spring weather (see Figure 2.4 – left). This meant that the cover crops were entering the third and final phase of their growth cycles where a plant diverts its energy resources into reproduction, thereby reducing the nutritional quality of the cover crops as a forage source (Beetz & Rinehart, 2010). The timing of rotational grazing, therefore, is essential in optimizing and properly managing forage resources. The ideal time to graze forage is in the latter half of the second phase when its nutritional value

and regrowth rate are at their highest peaks (Beetz & Rinehart, 2010). To revert the growth cycle to this second phase, I scythed the cover crops, and while doing so, I took some samples<sup>3</sup>, dried them and used their weights as baseline measurements in my calculations to estimate the amount of dry matter that was available in each paddock.

When the cattle arrived at the UBC Farm, one of the heifers, which was quite challenging to work with during my training sessions at Harold's farm, had difficulty settling in. I factored in an acclimation period for the cattle to adjust to their new environment before starting them in the rotation. But after several weeks of working with her, the decision was made to replace her with another heifer, which occurred midway through the project's timeline. These issues also contributed to the delays in the timing of the rotation. The chickens eventually arrived from the supplier and settled in after a couple of days.



**Figure 2.4:** Cover crops in the third growth phase (left); the cattle and chickens in their respective paddocks (centre, right).

Despite the numerous delays, the overgrown forage, and the issues with the difficult heifer, I continued with the rotation (see Figure 2.4 – centre and right, and Appendix A for additional photos). In the mornings, I opened the gates allowing the cattle to move from the shelter area to their designated grazing paddock. Using the dried forage sample weights and the

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<sup>3</sup> Samples were obtained using a 0.5 m x 0.5 m (or 0.25 m<sup>2</sup>) sampling frame that was tossed in a random section of a paddock. The forage sample within that frame was cut to a height of approximately 10 cm, which is the minimum height required for Italian ryegrass to generate regrowth (also known as the stubble height). The sample was put in a tared cloth bag and placed in a dryer for 24 hours at 50°C and then weighed.

dry matter intake requirements for beef cattle based on the heifers' weights and ages, I determined the amount of dry matter within each paddock and knew how long the cattle could remain in each paddock without overgrazing the forage. Like Salatin's rotation, I moved the chickens into a paddock approximately three to four days after the cattle grazed it, and moved the shelter, feeder and waterer to different locations each day the chickens remained in a paddock so that their manure deposits were more evenly distributed. In the evenings, I secured the cattle and chickens in their respective shelters. I did this six days a week (Mondays to Saturdays)<sup>4</sup> for approximately three months, after which, the cattle were transported back to Harold's farm and the chickens were sent back to the supplier.

### ***The Successes of Integrating Livestock at the UBC Farm***

Recall in Chapter 1 that successes were defined as to whether integrating livestock satisfied or fulfilled the mission of a campus farm or garden. With regards to Phase I, the integration of the cattle and chickens fulfilled the UBC Farm's mission via the four goal areas.

#### **Goal Area 1: Integration**

Integrating the cattle and chickens satisfied the first goal area (*Integration*) as it gave me an opportunity to combine my background and varied academic and personal interests in veterinary medicine, animal welfare, agroecology, and sustainable food systems in trialing a small-scale version of a multi-livestock species rotational grazing system at the UBC Farm, and disseminating my experience and research findings through this thesis.

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<sup>4</sup> The Farm's caretakers agreed to feed the chickens and to let them out into the paddock, but they did not feel comfortable letting the cattle out to graze on Sundays with no staff support on site, which was understandable. As a result, the cattle remained in their shelter area on Sundays and the caretakers fed them hay that I brought on site from Harold's farm.

## **Goal Area 2: Teaching and Learning**

In terms of *Teaching and Learning*, the integration of the cattle and chickens provided several unique, experiential learning and skill building opportunities, not only for me, but also for the Civil Engineering students who helped to construct a mobile chicken shelter for the project. From my perspective as a student, I was able to observe many of the short-term ecological impacts associated with integrating livestock into agroecosystems, and the inherent physiological behaviours of cattle and chickens that I learned in class and read in the literature. For example: the conversion of forage and feed by the cattle and chickens into manure and its deposition on Field D3-1 enabling nutrients to be returned to the soil via nutrient cycling; the ecological symbiosis between the cattle and chickens; and the grazing, foraging and dust bathing behaviours of the livestock in the rotation. Having the opportunity to witness and experience these agroecological processes and inherent behaviours through this project greatly enhanced my learning.

## **Goal Area 3: Research, Discovery and Partnerships**

With *Research, Discovery and Partnerships*, integrating the cattle and chickens at the UBC Farm allowed me to demonstrate an alternative, agroecological approach to livestock production, which served to engage the public and generate discussions and debates about current production methods and the ethics of raising livestock for food production in general. This project also served as a means by which a community partnership with Harold Steves and a Community Service Learning opportunity with the Applied Biology students were forged.

#### **Goal Area 4: Application**

The *Application* and incorporation of the knowledge and experience gained from the three aforementioned goal areas into the UBC Farm's day-to-day operations and land stewardship was evident in the 2012 growing season when the UBC Farm began integrating their laying hens into the main 8-year crop rotation, and has continued to do so to this day. Through this, the UBC Farm continues to provide students and the public with unique, educational and engagement opportunities, while managing both the land and the chickens in a way that reaps the ecological advantages of livestock-integrated agroecosystems, and allows the chickens to express their natural, physiological behaviours and tendencies.

#### ***The Challenges of Integrating Livestock at the UBC Farm***

In spite of the successes of integrating the cattle and chickens at the UBC Farm, I also experienced a number of challenges, which were defined in Chapter 1 as anything that poses some form of opposition to (but that does not prevent) the integration of livestock on campus farms and gardens. The first challenge was with regards to the ACC protocol application and approval process. The questions on the protocol application were (not surprisingly) centred around more traditional, laboratory research involving animals; and as a result, some of the questions were not very relevant to the project and its objectives. Coupled with this were the delays in the ACC approval process, which delayed the start of the project and the timing of the rotation.

The labour involved in this project posed a challenge as well. Though I was fortunate to have had the assistance of UBC Farm staff and caretakers, and the Applied Biology and Civil Engineering students, the work involved in integrating the cattle and chickens at the UBC Farm,

and into the main crop rotation specifically (from the field preparations to the day-to-day management of the livestock) was considerable, especially as the sole researcher. This, again, was not surprising given that integrating livestock in agroecosystems is generally more labour and management intensive (as discussed in the literature review); though I recognize that the design of my rotational grazing system may also have been a contributing factor (Dumont *et al.*, 2013; Franzluebbers, 2007; Hilimire, 2011; van Keulen & Schiere, 2004). In hindsight, having fewer but larger paddocks in the rotation would likely have reduced the amount of labour required to manage the livestock. But based on the size of Field D3-1 and the number of cattle and chickens I had to work with, I opted for smaller paddocks because they allowed me to maximize forage utility and availability.

Finally, I also found it challenging to work with the cattle, particularly at the start of the project. They were understandably stressed when they first arrived at the UBC Farm as any animal would be after being transported to and placed in a new environment. But I did not anticipate that the cattle (especially the heifer that had to be replaced) would take so long to adjust. While I am indebted to Harold for loaning me two of his Belted Galloways at no cost, in retrospect, the cattle were perhaps too large to be integrated into the UBC Farm's main crop rotation due to the size and scale of the production fields. However, I once again recognize that perhaps the size of my paddocks was not appropriate for the cattle, despite the fact that the dimensions met the BC SPCA and Canadian organic production standards for outdoor space and size requirements. The cattle were accustomed to large, open field spaces at Harold's farm, and so it is possible that the paddock sizes were too confining for them, which may have contributed to the behavioural issues I experienced in working with the cattle (Petherick & Phillips, 2009).

### **PREVIEW OF CHAPTER 3**

The preceding discussion of my experience in and resultant successes and challenges of integrating the cattle and chickens at the UBC Farm in Phase I sets the stage for Phase II, where the successes, challenges and barriers of integrating livestock on other campus farms and gardens were determined using qualitative research methodologies.



## **CHAPTER 3: QUALITATIVE METHODOLOGY (PHASE II)**

### **INTRODUCTION**

In this chapter, I will explain the paradigms that directed my methodological decisions for Phase II, the rationale for the qualitative approach to inquiry that I chose, the methods that I used to collect and analyze the data, and the limitations of Phase II.

### **PARADIGMS**

The main paradigm that guided my methodology in Phase II was pragmatism which is concerned, first and foremost, with “solving practical problems in the ‘real world’” (Creswell, 2007; Feilzer, 2009, p. 3; Mackenzie & Knipe, 2006). It focuses on the research problem and questions by giving researchers the freedom to choose and employ “...the methods, techniques and procedures of research that best meet their needs and purposes” without being bound by specific philosophies and/or approaches to research; and it is often used in studies employing mixed methods of data collection – both quantitative and qualitative (Creswell, 2007, p. 23; Feilzer, 2009; Mackenzie & Knipe, 2006). The practical and flexible nature of pragmatism was essential in Phase II as it allowed me to select the appropriate approach to qualitative inquiry and the methods that would yield accurate and rich responses to the research questions, while providing the context that I needed to understand the responses.

In addition to pragmatism, elements of the participatory paradigm also influenced my methodology. The participatory paradigm promotes a collaborative, equal relationship between the researcher and the participants (Bergold & Thomas, 2012; Creswell, 2007). It involves the participants as stakeholders, co-researchers and collaborators in the research design and decision-making process to build, share and disseminate knowledge and to generate debate or discussion

about a societal issue where participants can express their opinions and have a voice in matters that impact their lives (Bergold & Thomas, 2012; Creswell, 2007; Kemmis & Wilkinson, 1998). Unlike most researchers guided by participatory methodologies, I came into the research process having experienced aspects of the phenomenon under investigation – specifically the successes and challenges of integrating livestock on a campus farm – and as a result, I assume the roles of both the researcher and a stakeholder. Because of my unique perspective, I chose not to view and involve the participants as co-researchers or collaborators in the research design and decision-making process. Instead, I chose to view them as colleagues given that they have the same interests and stakes as mine in the subject matter and in the research outcomes. In doing so, I was still able to establish myself on equal footing with the participants in building, sharing and disseminating knowledge of integrating livestock on campus farms and gardens, which provided an opportunity to discuss the specific successes, challenges and barriers that they are currently experiencing and/or encountering (Bergold & Thomas, 2012; Creswell, 2007; Kemmis & Wilkinson, 1998). This collegial mindset, therefore, in no way lessened the voice of the participants in the research, but rather characterized and provided a framework for my approach to qualitative inquiry.

## **METHODS**

### ***Approach to Qualitative Inquiry***

There are several qualitative approaches that I considered in Phase II, each with its advantages and disadvantages. The phenomenological approach, for instance, is advantageous because it assists researchers in describing the “universal” or common meaning of a phenomenon among individuals who have experienced it – the phenomenon being the participants’

experiences of the successes, challenges and barriers of integrating livestock on their campus farms and gardens (Creswell, 2007, p. 58). A disadvantage of using phenomenology in this case is the possibility that it would not be able to account for the differences among the campus farms and gardens in its attempts to seek common meanings of the successes, challenges and barriers of integrating livestock on these sites. Also, Creswell (2007, p. 61) states that the phenomenological researcher must also "...bracket out, as much as possible, their own experiences" of the phenomenon which, as previously discussed, was an important and defining feature of this study that I could not overlook or "bracket out". Case study research is another advantageous qualitative approach that I considered as it assists researchers in analyzing an issue through data collected across one or more representative cases (Creswell, 2007). A key characteristic of case study research is that it respects the distinct nature of the individual cases under investigation, and thus, would be able to account for the differences among the campus farms and gardens, compared to the phenomenological approach (Creswell, 2007). However, case study researchers are typically limited to no more than four or five cases to prevent data analysis dilution, and this limitation would have made it difficult to find any potential common meanings or generalizations with regards to the successes, challenges and barriers of integrating livestock on campus farms and gardens (Creswell, 2007).

In the end, I chose the qualitative description approach because it provides the same advantages as the phenomenological and case study approaches. It allows researchers to summarize and describe common meanings of a shared phenomenon among those who have experienced it, while not excluding the researchers' personal experiences or perspectives of the phenomenon in the study (Sandelowski, 2000). It also allows for cases to be studied in their "...natural state or as [they are] ...", thereby respecting the distinct nature of the individual

cases, while not limiting the number of cases under investigation (Sandelowski, 2000, p. 337). Furthermore, the qualitative description approach presents a rich and straightforward description and analysis of the data collected which, with respect to Phase II, allowed me to stay as close to the participants' firsthand experiences as possible and to ensure their voices were heard throughout the research (Neergaard, Olesen, Andersen & Sondergaard, 2009; Sandelowski, 2000; Sandelowski, 2010).

### ***Research Design and Data Collection***

For the intents and purposes of Phase II, I chose to define campus farms and gardens as sites that:

1. Grow/produce (and possibly sell) some type(s) of field and/or horticulture crop(s).
2. Operate at, by people affiliated with, and/or in partnership with a post-secondary educational institution (i.e. a college or a university) in Canada or the United States.
3. Are run by students of the post-secondary institution (as part of a student organization, group or club), and/or for students of the post-secondary institution (through academic course work, self-directed projects, leadership and/or volunteer opportunities, part-time and/or full-time employment, etc.).
4. Have some type of learning component, whether it be for the students of the post-secondary institution, the part-time or full-time employees of the campus farm or garden, and/or for the community members that are involved with the campus farm or garden in some capacity.
5. May or may not have livestock.

Phase II was divided into two parts: Part 1 – a survey of campus farms and gardens; and

Part 2 – in-depth, semi-structured interviews to discuss the successes, challenges and barriers of integrating livestock on campus farms and gardens.

### **Part 1: Survey of Campus Farms and Gardens**

In Part 1, I developed a short, online survey (hosted by the UBC Survey Tool) with the primary objective<sup>5</sup> of seeking interview participants for Part 2, and so it was necessary to select an appropriate sampling strategy that would allow me to reach my target survey audience.

According to Sandelowski (as cited in Sandelowski, 2000, p. 337-338), the qualitative description approach is often associated with maximum variation sampling – a technique that “...allows researchers to explore the common and unique manifestations of a target phenomenon across a broad range of phenomenally and/or demographically varied cases”. As discussed in Chapter 1, when I was creating the list of campus farms and gardens in my preliminary research, I noticed that the types of campus farms and gardens varied, though I also recognize that the information sources I used to create this list were either incomplete, outdated and/or unverified. Because of this, I was not able to completely rely on the accuracy of the information, nor make any assumptions about the campus farms and gardens based on the information I had gathered. So, it seemed beneficial for my purposes in Part 1 to send the survey to as many campus farms and gardens as possible to not only verify and update the information on the list I created, but also to allow me to gather data across the diverse spectrum of campus farms and gardens as a maximum variation sampling strategy. Therefore, I decided to send an email invitation, which

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<sup>5</sup> A secondary objective of the online survey in Part 1 was to create an online directory of campus farms and gardens in partnership with the Centre for Sustainable Food Systems - UBC Farm (CSFS). The purpose of the directory is to establish a campus farm and garden network to increase communication and collaboration among North American post-secondary institutions involved in sustainable food systems research and initiatives. Although it was beyond the scope of this study to complete this objective, it is my intention to continue to work with the CSFS in creating this directory.

included the survey URL and a letter of initial contact providing details about the study, to all campus farm and garden directors, managers or designates holding a position of authority or leadership, and to the listserv of the Sustainable Agriculture Education Association (SAEA) as well.

The initial questions on the survey asked the participants to provide general, descriptive information about their respective campus farms and gardens, such as the year of establishment and the types of crops grown. These were followed by a series of open-ended and closed-ended branching questions about livestock integration on their sites. The first question in this series asked the participants if their campus farms and gardens were currently integrating livestock. If they replied “Yes”, the following questions asked for specific information about the livestock (i.e. species/type(s), number of each species/type, and how long they have had each species/type). If they replied “No”, the branch of questions that followed asked if their campus farms and gardens had integrated livestock in the past; and if “Yes”, the participants were then asked for details about the livestock (i.e. species/type(s), numbers of each species/type, how long they had each species/type, and how long ago this was). Regardless of whether the campus farms and gardens had integrated livestock in the past or not, the last question in this series asked the participants if they wanted to integrate livestock on their campus farms and gardens in the future and the reasons why. The survey concluded by asking the participants if they wanted to be interviewed in Part 2, and to review the list of campus farms and gardens that received the study invitation to see if they could identify others that were missing from the list. This was a form of snowball sampling to, once again, reach as many campus farms and gardens as possible recognizing that the list that I created was not exhaustive (Babbie, 2004). Campus farms and

gardens that were identified through this process were also sent the email invitation to participate in this study.

Due to the limited timeframe that I had to complete Phase II, participants were given a little over two weeks<sup>6</sup> to respond to the survey. A reminder email was sent to all campus farms and gardens a week before the survey's closing date. Of the 144 campus farms and gardens that were contacted via email and those that received the invitation via the SAEA listserv, there were 28 participants<sup>7</sup>, of which 22 agreed to be interviewed. (See Appendix B for the survey questions.)

## **Part 2: In-Depth, Semi-Structured Interviews**

The branching questions in the survey served to separate the campus farms and gardens into five interview categories (see Figure 3.1):

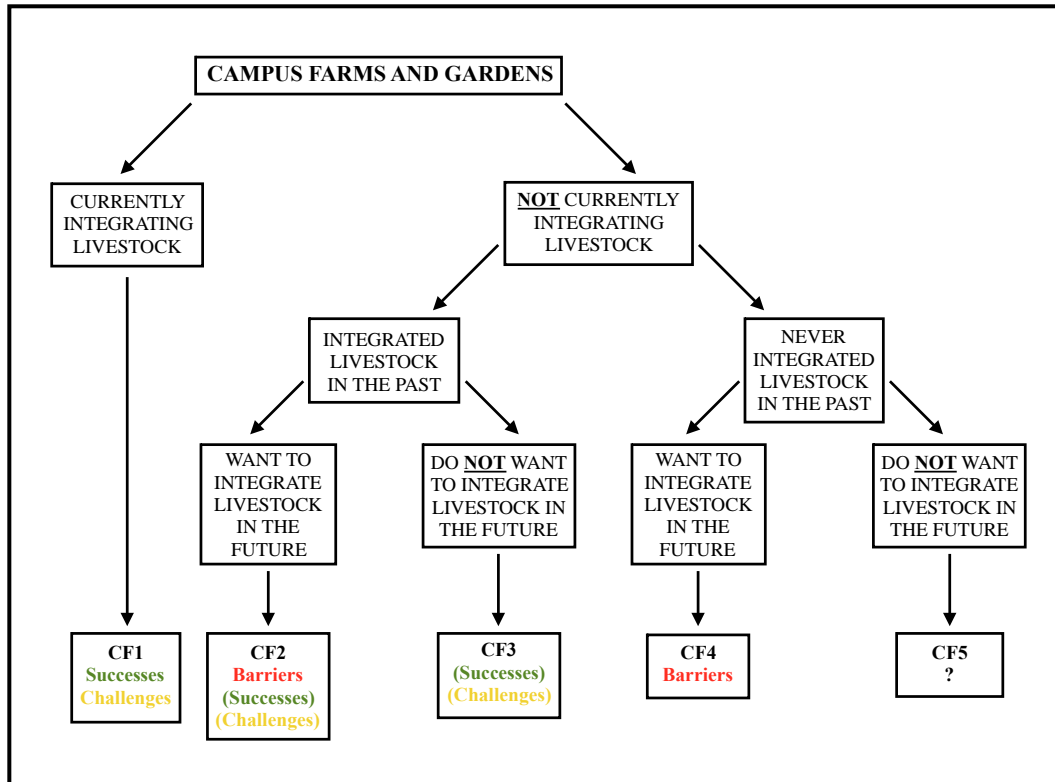
1. **CF1** (Campus farms and gardens that are currently integrating livestock.)
2. **CF2** (Campus farms and gardens that are NOT currently integrating livestock, but did in the past, and want to in the future.)
3. **CF3** (Campus farms and gardens that are NOT currently integrating livestock, but did in the past, and DO NOT want to in the future.)
4. **CF4** (Campus farms and gardens that have never integrated livestock, and want to in the future.)
5. **CF5** (Campus farms and gardens that have never integrated livestock, and DO NOT want to in the future.)

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<sup>6</sup> The survey remained open beyond the two-week period just in case participants were not able to respond by the deadline.

<sup>7</sup> It was difficult to determine the response rate of the survey since the invitation was also sent to the SAEA listserv, but based on the email invitations alone, the response rate was 19.4% (= 28/144).

Each campus farm or garden participant spoke of either the successes, challenges or barriers of integrating livestock (or a combination of the three), depending on their assigned category as illustrated in Figure 3.1. Parentheses around “Successes” and “Challenges” indicate that the participants were able to speak of the successes, challenges and/or barriers of integrating livestock if they had the necessary knowledge and/or experience.



**Figure 3.1:** Interview categories of the participating campus farms and gardens.

As for the CF5 participants, I was originally planning to exclude them from Part 2 thinking that they would not be able to speak of any successes, challenges or barriers because their campus farms and gardens have never integrated, nor want to integrate livestock. I was also not expecting CF5 participants to agree to be interviewed. But a member of my Supervisory Committee suggested that CF5 participants might offer a unique perspective on livestock integration, and so I reconsidered and included them. I did, however, exclude large, research station-type campus farms and gardens that are focused on conventional livestock production



and/or large animal veterinary medicine because the successes, challenges and barriers of integrating livestock on these sites would not be comparable to those on smaller-scale campus farms and gardens, like the UBC Farm. This form of purposeful sampling, used in qualitative description research, targets participants or cases that provide the most relevant and information-rich responses to the research questions (Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood, 2015; Sandelowski, 2000).

The interview questions were divided into two sections. In the first section, I performed a systems analysis of each campus farm or garden that was interviewed (as I had done in Phase I with the UBC Farm, but from a more general perspective), asking the participants to discuss the goals, boundaries, components and key boundary-component and component-component interactions that characterized their campus farms and gardens. This was to provide context for their responses in the second section where I asked the participants a specific set of questions related to livestock integration depending on their campus farms and gardens' assigned interview category. CF1 participants, for example, were asked questions about the processes involved in integrating livestock on their sites, the challenges they experienced and/or are experiencing, and the successes of integrating livestock (i.e. if the integration of livestock fulfills the mission of their campus farms and gardens, and their reasons why). In contrast, CF4 participants were asked questions about their reasons for wanting to integrate livestock on their campus farms and gardens, the types of livestock they want to integrate, the roles livestock would play on their sites, and the barriers that are preventing them from integrating livestock. Regardless of a campus farm or garden's interview category, I asked all participants if livestock integration has benefited or would benefit their campus farms and gardens (or campus farms and gardens in

general for CF5 participants) and their reasons why. (See Appendix B for the interview questions.)

I emailed the participants to schedule the interviews that were held via Skype (video or audio), Google hangouts or phone depending on which communication method each participant had access to or preferred. I sent the participants the interview questions one to three days prior to the interview date so that they could prepare their responses in advance if needed. Verbal consent was obtained from each participant before the interview began (the ethical considerations of this study are discussed in more detail later in this chapter). During the interviews, I took memo notes which allowed me to monitor the conversation, clarify participants' statements and ask follow-up questions when required. All interviews were audio recorded and ranged between 35 to 114 minutes in length.

### ***Data Analysis (Part 2)***

Qualitative content analysis is a technique frequently used to analyze data in qualitative description research that aims to “re-present” the data in a way that best describes and summarizes the findings (Sandelowski, 2000, p. 338). Like other qualitative data analysis methods, qualitative content analysis uses codes and coding systems, but it also involves some quantitative analytical methods such as counting the frequency of certain responses among the participants to describe patterns or trends and to uncover hidden truths within the data (Sandelowski, 2000). A key characteristic of coding systems in qualitative content analysis is that they are continuously being developed from and shaped by the data to give researchers the flexibility and ability to allow the data to essentially “speak for itself” (Sandelowski, 2000).

Using qualitative content analysis, I began by listening to the audio recordings of the interviews to re-familiarize myself with each conversation. Simultaneously, I began establishing a preliminary coding system by writing down the participants' responses of the successes, challenges and barriers of integrating livestock on their campus farms and gardens on coloured pieces of paper (each of the five interview categories was represented by a specific colour). These coloured papers were sorted into piles as either "Successes", "Challenges" or "Barriers". Responses that were mentioned by more than one participant were grouped together forming tentative codes, and this resulted in the formation of a preliminary coding system. I entered this coding system into the qualitative data analysis software, NVivo<sup>8</sup>, to provide a baseline coding structure in preparation for a more thorough analysis of the interview data.

I transcribed each interview audio recording verbatim into a Word document and uploaded the files to NVivo. I read through each interview transcription, beginning with the systems analysis to provide the necessary context and background information, and assigned the participants' responses of the successes, challenges and barriers of integrating livestock to a specific code using the preliminary coding system as a guide. As I read and re-read the transcriptions, I continued to modify the coding system and its structure, merging and consolidating specific codes that were mentioned together by participants, and grouping them under thematic codes (or themes). These themes were grouped under the primary codes: "Successes", "Challenges" and "Barriers". I also analyzed the participants' responses pertaining to the benefits of integrating livestock on campus farms and gardens in the same manner by grouping them into thematic codes based on their similarities.

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<sup>8</sup> NVivo was chosen as the qualitative data analysis software because I was somewhat familiar with the program's functions and capabilities after attending some NVivo workshops offered by UBC, and I found it to be a useful tool in analyzing the interview data.

## ***Research Ethics***

Phase II required ethics approval by the University of British Columbia Behavioural Research Ethics Board (BREB) as it involved human participants. In terms of informed consent in Part 1, the first question in the survey stated that consent was implied if the participants completed the survey and asked if they wished to proceed. Answering “Yes” took the participants through the rest of the survey; answering “No” took them to the termination page. For Part 2, verbal consent was approved by the BREB and, as mentioned, was obtained from each participant before the interview began. Participation in this study was completely voluntary, which was made explicit in the letter of initial contact. Also included in this letter was information regarding the research risks and participant vulnerability level. Parts 1 and 2 were identified as having low research risks and participant vulnerability, with the only risks to the participants being if their responses during the interviews in Part 2 reflected poorly or negatively on the post-secondary institutions with which they are affiliated. However, participants were given the option to provide as much or as little detail as possible in their responses and to refrain from answering questions that they felt may have posed some form of social risk to either themselves or to the campus farms and gardens they represented. To ensure the anonymity of the participants, each campus farm or garden was assigned a specific identification code, formed using the interview category it belonged to and a letter identifying it as one of the campus farms and gardens in that category. For example: campus farms and gardens categorized as CF1 were identified as CF1-A, CF1-B, CF1-C, etc. in the data. The interview participants and their respective campus farms and gardens will be referred to by their specific identification/participant codes moving forward.

As an incentive to elicit participation in this study, participants were entered into a draw

to receive two sets of books related to agriculture and/or livestock welfare, care and handling in agricultural systems – one set for a participant of Part 1 and another for Part 2.

## **LIMITATIONS OF PHASE II**

Despite the amount of preliminary research that I did and the various sampling strategies I employed to reach as many campus farms and gardens as possible, one of the limitations of Phase II was the fact that some campus farms and gardens were likely (though not deliberately) left out of the study. As mentioned, the list of campus farms and gardens used in Part 1 was derived from either incomplete, outdated and/or unverified sources. Because of this and the recent proliferation of campus farms and gardens at Canadian and especially American post-secondary institutions as per Sayre and Clark (2011), some newer and/or smaller-scale (i.e. lesser known) campus farms and gardens were likely not on the list nor on the SAEA listserv, and did not receive the invitation to participate in Phase II as a result.

Another limitation was the timing of Phase II and the limited timeframe that I had to complete it. I sent the email invitation towards the end of the growing seasons for most campus farms and gardens in Canada and the United States (specifically on November 2<sup>nd</sup>, 2016) in the hopes that doing so would increase participation rates. But based on the feedback from some of the participants, it seems as though this may have been advantageous for some campus farms and gardens, but not for others. Also, given the limited timeframe that I had to complete Phase II, I needed to schedule most of the interviews before the Christmas holidays, which meant that I was not able to leave the survey open for very long. Sending the invitation earlier and/or giving campus farm and garden representatives more time to respond to the survey may have increased participation rates in Phase II.

# CHAPTER 4: RESULTS AND DISCUSSION

## INTRODUCTION

The findings from the interviews conducted in Phase II (Part 2) are presented in this chapter through an examination of the participants' responses of the successes, challenges and barriers of integrating livestock on their campus farms and gardens, and a comparison of the findings with the successes and challenges I experienced in Phase I.

## OVERVIEW OF CAMPUS FARMS AND GARDENS

The 22 participating campus farms and gardens were separated into the five interview categories. As shown in Table 4.1, none of the participating campus farms and gardens were categorized as CF3, which I expected as the representatives from these campus farms and gardens may have felt that this study was not relevant to them because they have no intention of integrating livestock in the future on their sites. With this reasoning, I thought that the same would be true of CF5 representatives, however, three agreed to be interviewed.

CATEGORY	DEFINITION OF CATEGORIES	NUMBER OF CAMPUS FARMS AND GARDENS
CF1	Currently integrating livestock	11 (CF1-A to CF1-K)
CF2	Integrated livestock in the past and wants to in the future	1 (CF2-A)
CF3	Integrated livestock in the past and DOES NOT want to in the future	0
CF4	Never integrated livestock before and wants to in the future	7 (CF4-A to CF4-G)
CF5	Never integrated livestock before and DOES NOT want to in the future	3 (CF5-A to CF5-C)

**Table 4.1:** Number of participating campus farms and gardens per interview category.

Table 4.2 lists the campus farms and gardens by their participant codes and includes some general information about each of them from their respective systems analyses to provide context for the participants' responses in this discussion.

CODE	SIZE OF CAMPUS FARM OR GARDEN (in hectares)	PAID LABOUR	UNPAID LABOUR	SPECIES AND NUMBER OF LIVESTOCK	TYPES OF CROPS GROWN
CF1-A	24 (~3.4 in production)	Staff: 10 full-time; 4 part-time Students: 16 (varies)	Volunteers, Practicum, interns	Layers (150)	Field-grown and greenhouse-grown vegetables, berries, herbs, flowers
CF1-B	121 (~111 in production)	Staff: 2 full-time Students: 3-25 (varies)	N/A	Beef Cattle (180); Pigs (185); Layers (250); Broilers (1200); Sheep (75)	Field and forage crops, field-grown and greenhouse-grown vegetables, tree fruits and nuts, herbs, flowers
CF1-C	0.4 (~0.3 in production)	Staff: 3-4 full-time Students: ~25 (varies)	Volunteers	Layers (6)	Field and forage crops, field-grown and greenhouse-grown vegetables, tree fruits and nuts, berries, herbs, flowers
CF1-D	2.3 (2.1 in production)	Staff: 1 full-time, 1 part-time Students: 10	Volunteers, interns	Broilers (300-600)	Field and forage crops, field-grown and greenhouse-grown vegetables, tree fruits and nuts, berries, herbs, flowers
CF1-E	60.7 (plus ~45,000 ha of grazing land for cattle)	Staff: 2 full-time, 2 part-time Students: ~4-5	N/A	Beef Cattle (150-200); Layers (50-200); Broilers (600); Turkeys (15); Pigs (4-12)	Field and forage crops, greenhouse-grown vegetables, tree fruits and nuts
CF1-F	~121.4 (11-14 in production)	Staff: 4-5 full-time Students: ~22-30 (varies)	N/A	Cattle, various (13); Broilers (500); Horses (3); Turkeys (150); Layers (80); Sheep (15); Pigs (12)	Field and forage crops, field-grown and greenhouse-grown vegetables, tree fruits and nuts, berries, herbs, flowers
CF1-G	20.2 (2.2 in production)	Staff: 2 full-time Students: 0	Interns, some volunteers	Pigs (4)	Field-grown and greenhouse-grown vegetables, berries, herbs
CF1-H	~1 (all in production)	Staff: 1 full-time Students: 10	Volunteers	Layers (36)	Field-grown and greenhouse-grown vegetables, tree fruits and nuts, berries, herbs, flowers
CF1-I	20.2 (~17 in production)	Staff: 3 full-time, 5-6 part-time Students: ~10-15 (varies)	Volunteers	Pigs (20)	Field and forage crops, field-grown and greenhouse-grown vegetables, herbs, flowers
CF1-J	8.1 (~3.6 in production)	Staff: 1 full-time (plus part-time staff support) Students: ~10-12	Volunteers	Sheep (8); Layers (35); Ducks (15)	Field-grown and greenhouse-grown vegetables, tree fruits and nuts, berries, herbs, flowers
CF1-K	0.8 (~0.4 in production)	Staff: 1-2 full-time Students: ~1-5 (varies)	Volunteers	Layers (5-20)	Field-grown and greenhouse-grown vegetables, berries, herbs, flowers
CF2-A	1.2 (all in production)	Staff: 2 full-time Students: 2	Volunteers	Previously integrated layers (60)	Field-grown and greenhouse-grown vegetables, berries, herbs, flowers
CF4-A	10.1 (1.2 in production)	Staff: 0 Students: 1	Some volunteers	N/A	Field-grown and greenhouse-grown vegetables, herbs, flowers
CF4-B	12.1 (2.8 in production)	Staff: 1-2 full-time Students: 8	Volunteers	N/A	Field-grown vegetables, tree fruits and nuts, herbs
CF4-C	0.4 (0.2 in production)	Staff: 1 full-time Students: 3	Volunteers, interns	N/A	Field-grown and greenhouse-grown vegetables, tree fruits and nuts, berries, herbs, flowers
CF4-D	0.1 (all in production)	Staff: 1 full-time, 1 part-time Students: 1	Volunteers	N/A	Field-grown vegetables, herbs, flowers
CF4-E	0.4 (all in production)	Staff: 3 full-time Students: 7-9 (varies)	Some volunteers	N/A	Field and forage crops, field-grown and greenhouse-grown vegetables, berries, herbs, flowers
CF4-F	0.4 (0.2 in production)	Staff: 1 (Faculty) Students: ~4-7	Volunteers	N/A	Field-grown and greenhouse-grown vegetables, berries, herbs, flowers
CF4-G	2.4 (0.6 in production)	Staff: 1 (+ Faculty support) Students: 2	Volunteers	N/A	Field-grown and greenhouse-grown vegetables, herbs, flowers
CF5-A	0.04 (all in production)	Staff: 1 Students: 0	Volunteers	N/A	Field-grown vegetables, herbs, flowers
CF5-B	0.3 (all in production)	Staff: 2 part-time Students: 3	Volunteers	N/A	Field-grown and greenhouse-grown vegetables, berries, herbs, flowers
CF5-C	2 (all in production)	Staff: 1 full-time, 2-4 part-time Students: 4	Volunteers, interns	N/A	Field-grown and greenhouse-grown vegetables, herbs, flowers

**Table 4.2:** Overview of the 22 campus farms and gardens interviewed in Phase II (Part 2).

# OVERVIEW OF RESULTS

Figure 4.1 summarizes the findings, showing the participants' responses of the successes, challenges and barriers of integrating livestock on their campus farms and gardens.



**Figure 4.1:** Coding map of the findings from an analysis of the interviews.



## SUCCESSSES OF INTEGRATING LIVESTOCK

Twelve participants (eleven CF1s and CF2-A) spoke of the successes of integrating livestock on their campus farms and gardens during the interviews. Ten CF1 participants said that the integration of livestock fulfills the mission of their campus farms and gardens, and Participant CF2-A said that while integrating livestock fulfilled its mission, “...*it needs to be approached cautiously and with safeguards*” in the future. As for the other CF1, at the time of the interview, CF1-I operated as a privately-owned farm located at its post-secondary institution (though ownership of the farm was being transferred to the institution in 2017), and the participant said that they chose to integrate livestock primarily because they wanted to produce and sell pork. However, Participant CF1-I went on to say that the integration of the pigs “indirectly” fulfills CF1-I’s mission through its on-farm student engagement activities and events, and that despite its for-profit model, CF1-I is still very much affiliated with its post-secondary institution, hence why I chose to include the responses from CF1-I in this study.

The twelve participants were asked to provide reasons as to why the integration of livestock fulfills the mission of their campus farms and gardens, and an analysis of their responses revealed three common themes: social successes, ecological successes and economic successes.

### ***1. Social Successes***

Regardless of whether integrating livestock directly or indirectly fulfills the missions of the campus farms and gardens, all twelve participants said that integrating livestock provides their students with real-world, hands-on, experiential learning opportunities. They also said that it affords unique educational opportunities that students may not be able to experience elsewhere

and imparts skills not only in sustainable livestock production and animal husbandry, but important transferable and workplace skills as well (i.e. responsibility, accountability, problem solving and critical thinking, etc.).

*“...having livestock integrated into the farm allows me in the classroom to talk about agroecology in a way that students have some practical experience with. And to have a more complete farm system allows us to talk more personally about sustainable systems, about nutrient cycling, about food systems, and that’s really important. And it’s important for them to get experiences with as many enterprises as possible on the farm.”* (Participant CF1-G)

*“...having different enterprises that you have to manage really helps the students for their business skills, for their planning skills just for seeing reality I guess, like the reality of the cost of feed...it helps strengthen their reality-based knowledge as they go forward.”* (Participant CF1-K)

*“...having [livestock] gives students an opportunity to do work that forces them to take on responsibilities that they wouldn’t otherwise have, and take on responsibilities that force them to be directly responsible to the community. ...they’re dealing day-to-day with living animals and they have to pay attention to them and tend to them and focus on them.”* (Participant CF1-E)

The participants also mentioned that integrating livestock on their campus farms and gardens serves as an attractant to students (both current and prospective) and to members of the community as well. It engages those who perhaps would not be involved with campus farms and gardens if not for the livestock, and it exposes students and community members to a demonstration of alternative, agroecological livestock production practices.

*“...the thing that I hadn’t kind of anticipated I guess was how excited people are about animals. ...the engagement with the public piece is something that I hadn’t quite anticipated being as strong. People are really excited about the animals. So, families but also students that come – prospective students, students that are already here, their families...we also have people from the community walking through and looking at the animals.”* (Participant CF1-J)

*“...I think that in terms of doing the high quality research and outreach education, we’re exposing both students and the general public to these methodologies that are kind of cutting edge in their own way... it’s increased student activity in terms of different students being involved at the farm than normally would be. I mean we’re mostly a vegetable-fruit production farm and so we get a lot more interest from Animal Science students and students that wouldn’t normally be interns with the farm typically.”* (Participant CF1-D)

## 2. *Ecological Successes*

Ten CF1 participants said that livestock provided their campus farms and gardens with ecological services, namely through the conversion of feed into manure (which increases soil organic matter and fertility, and facilitates nutrient cycling); through the management of pests and the landscape via foraging and grazing; and through the utilization of crop waste as a supplemental feed source for livestock.

*“...fertility is a huge one. So, we farm in a place with generally fast leaching acidic soils so the addition of organic matter is really important to improving fertility, water holding capacity, drainage, all those things. And livestock allow us to do that fairly effectively both through our composting and also through our grazing systems.”* (Participant CF1-F)

*“...[the livestock] prepares the soil for planting and it serves as a nutrient cycling resource for us too with our waste that’s faster than composting. We can get nitrogen back into the soil quickly that way... It helps us to transition portions of our farm from being brush into being productive for vegetables. It helps us recycle the nutrients in our waste efficiently.”* (Participant CF1-G)

*“...we’ve seen an increase in our soil pH in all our bottomland... We’ve also shown a slight increase in our soil organic matter. And those are real successes for how are we taking care of our soil here.”* (Participant CF1-B)

Participants CF1-E and CF2-A did not specifically mention ecological services or any other ecological successes of integrating livestock in their responses. According to CF2-A’s systems analysis, approximately 60 layers were integrated in previous years, but the participant said that they were not managed in a way that would provide any significant ecological services. CF1-E’s systems analysis, on the other hand, showed that several livestock species are currently integrated (see Table 4.2), and so the livestock should be providing some, if not all, of the ecological services listed by the other participants. A possible explanation as to why Participant CF1-E did not mention any ecological services is that livestock integration is primarily a means to educate and engage their students (i.e. social successes), and serves a greater role for CF1-E and its post-secondary institution in that regard:

*“...the point of all of those operations is to basically put students in a position of responsibility doing meaningful work.”* (Participant CF1-E)

### **3. Economic Successes**

In terms of economic successes, six CF1 participants said that integrating livestock allows them to generate revenue by selling animal-based food products through their various sales and marketing channels and to diversify their enterprises. As for the other six participants who did not discuss economic successes, their campus farms and gardens either do not have enough livestock to generate a significant amount of revenue, or direct their animal-based food products internally to their post-secondary institutions' dining halls.

## **CHALLENGES AND BARRIERS OF INTEGRATING LIVESTOCK**

The same twelve participants (CF1s and CF2-A) also spoke of the challenges of integrating livestock, which as previously discussed, were defined as anything that poses some form of opposition to (but that does not prevent) livestock integration on campus farms and gardens. Barriers, on the other hand, were defined as anything that prevents or inhibits the integration of livestock on campus farms and gardens, specifically those categorized as CF2 and CF4; and as per Table 4.1, there were seven CF4s and CF2-A. Recall that three CF5 representatives agreed to be interviewed, and upon doing so, it became apparent that two of the campus farms and gardens (CF5-A and CF5-B) could possibly be categorized as CF4 because they, in fact, want to integrate livestock, but the barriers that they are encountering seem insurmountable. For clarity and consistency, however, I chose to keep them as CF5, but I included their responses in this study. The third campus farm or garden, CF5-C, was correctly categorized. The participant stated that they do not want to integrate livestock because it is not

necessary in fulfilling CF5-C's mission which, according to the participant, is *“to grow produce for the Department of Dining Services where [CF5-C] is managed, support educational opportunities for students at the [post-secondary institution] and to provide food to people in [their] community who are in need”*. Therefore, including CF5-A and CF5-B, a total of ten participants spoke of the barriers of integrating livestock.

As I was analyzing and coding the interview data, I noticed that all of the barriers mentioned by these ten participants were also mentioned as challenges by the other twelve participants. In other words, each of the eleven barriers that are preventing campus farms and gardens from integrating livestock is also one of the fifteen challenges that campus farms and gardens are experiencing as they integrate livestock. I also noticed this when I was analyzing the interview with Participant CF2-A as the barriers that are preventing them from integrating livestock are also the challenges that they experienced when livestock were previously integrated; though it is difficult to know if the same could be said for other CF2s because CF2-A was the only participant of its category in this study. Thus, for the sake of brevity, I have chosen to present the challenges and barriers together in the following section, though I have purposely discussed them separately to allow the voices and perspectives of each group of participants to be heard<sup>9</sup>.

The fifteen challenges and eleven barriers have been divided into three main themes that arose during my analysis. These themes were: challenges and barriers pertaining to the campus farm or garden's affiliation with a post-secondary institution (Institutional); challenges and

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<sup>9</sup> Participant CF2-A's responses were accounted for in the data as challenges and as barriers, therefore, whenever CF2-A's challenges are discussed in the following section, it is understood that the same responses can be used in the discussion of CF2-A's barriers.

barriers pertaining to the management of livestock (Management); and challenges and barriers pertaining to the physical site or space of the campus farm or garden (Physical site).

## ***1. Institutional Challenges and Barriers***

### ***a. Ethical Concerns***

Seven CF1 participants discussed the challenge of having to deal with the ethical concerns of raising livestock for food production expressed by the students of the post-secondary institutions, as well as the customers of the campus farms and gardens and/or members of their local communities.

*“In terms of philosophical and ethical perspectives or concerns about raising livestock, we do get some community push back. It’s only from a small group of radical students for lack of a better term that are animal rights advocates and from the vegan side of things.”* (Participant CF1-B)

*“...periodically we will have people who feel that we shouldn’t be raising animals. But that tends to be a small population. We also have encountered some outside groups who feel that we shouldn’t raise animals. So, I’d say that is probably the most uncomfortable thing.”* (Participant CF1-F)

Raising livestock for food production is undoubtedly a hotly contested issue in our society, especially with the increase in public education and awareness of the “origins” of their food – where it comes from, how it is grown or produced and, more relevantly, how livestock are raised in these production systems. Because of their affiliation with post-secondary institutions, campus farms and gardens are in the public eye, and as a result, those that integrate livestock are subject to a certain degree of public scrutiny which would not necessarily be the case on a privately-owned and operated farm.

*“...there can be squeamishness about death and taking the lives of animals for food and so putting that in a public setting...it makes it tricky to do ‘cause there’s the*

*concern of public protests...it's one thing for a private farm, for this stuff to be done out of the city somewhere...there might be some people who would feel that "oh if children come and see animals we couldn't tell them they're going to be killed and eaten"...it comes in direct conflict with the idea of animals being a part of ecosystems and agricultural systems, so there's a difference of beliefs." (Participant CF1-A)*

In contrast, only one campus farm or garden, CF4-C, cited *Ethical Concerns* as a barrier because their post-secondary institution has experienced some animal rights activism in the past.

*"We're concerned about the "open to the public" aspect of [CF4-C] because of the chickens and the public does crazy stuff. The [animal ethics committee] is particularly concerned ...about the activists' response to having animals on campus. They have just built a large animal research facility and there has been a lot of pushback from the public on that so all of that comes into play." (Participant CF4-C)*

Participant CF4-C said that they are expecting to integrate livestock sometime in 2017 and while this barrier has not necessarily prevented them from moving forward with their plans, it is something that they will need to consider and anticipate as they proceed.

#### ***b. Animal Ethics Committees***

Post-secondary institutions in the United States that conduct federally-funded research involving animals and that use animals in teaching are required to have an Institutional Animal Care and Use Committee (or IACUC). Like the Animal Care Committee at UBC, IACUCs govern the care and use of animals at post-secondary institutions by reviewing research and teaching protocols.

The process of integrating livestock on campus farms and gardens with IACUCs compared to those with CCAC-designated Animal Care Committees is generally the same. The regulations require representatives from a campus farm or garden to prepare paperwork detailing and justifying their use of animals, the numbers of animals they require, and any procedures that will be performed on or by the animals. The paperwork

is then submitted to the post-secondary institution's animal ethics committee for review and must be approved before livestock can be integrated. This approval depends on whether the campus farm or garden's proposal conforms to the animal ethics committee's regulations. Individual animal ethics committees may also choose to adopt and impose more stringent standards at their respective post-secondary institutions.

Of the twelve campus farm and garden participants, only four (3 CF1s and CF2-A) mentioned *Animal Ethics Committees* as a challenge.

*“And then there's also [animal ethics committee] regulations as being part of a university, so all of those while not necessarily making it impossible just create a lot more work and in some cases would make certain things impossible... The animal [ethics committee] restrictions are a challenge, not because we want to manage animals in an abusive way but because...agricultural production doesn't fit very well within that system.”* (Participant CF1-A)

*“Just keeping that regulatory stuff up to date...is definitely the biggest challenge...there's a big form that has to be filled out, there's training that has to be done by the staff and the interns or anybody who's going to work with the chickens to have approval to work with the animals. And it's kind of ridiculous because [it's] for research lab animals not for domesticated chickens.”* (Participant CF1-D)

Similarly, *Animal Ethics Committees* was only mentioned as a barrier by four participants (3 CF4s and CF2-A). Participant CF4-C described their experience with the animal ethics committee at their post-secondary institution as an arduous, two-year process that consisted of meeting all of the committee's regulations and requirements, which included restrictions on individuals who can be involved with the livestock and the extent of their responsibilities, “rigorous training” for those who are involved, restrictions on the suppliers of the livestock, etc. Participant CF4-C further explained:

*“In order to get accredited from [the animal ethics committee] and achieve their higher standards, they have pretty stringent requirements that shape everything. For instance...[the chickens] need electricity ...they needed certain air circulation minimums and so it just made for higher standards that we had to meet which the federal government actually requires... So that's the thing that's been the most*



*difficult [barrier] in getting the approval for having chickens. And understandably [the post-secondary institution] take[s] it very seriously.”*

The other two CF4 participants said the barrier for them was that there was no animal ethics committee protocol for non-laboratory research animals at their post-secondary institutions.

*“In terms of animals specifically, the main [barrier] as I understand it has been that there’s...no protocol around non-laboratory animals. And so administratively it feels like there’s a ton of hoops that we would need to go through... So, to have animals for example in a non-climate controlled environment would be a ton of red tape. So, it feels like a substantive barrier...” (Participant CF4-E)*

*“So, the biggest thing as far as livestock specifically is that we have policies for research animals and that’s it and we’ve approached them before...about [integrating] livestock...and they won’t let us do any of that because they’ll only follow the research animal policies...they’re just not willing right now to change their policies and work with us.” (Participant CF4-F)*

For CF2-A, even though *Animal Ethics Committees* is both a challenge and a barrier, the participant stressed the necessity of these regulatory protocols:

*“...we have an animal [ethics] committee...there’s a form or some paperwork we’d need to do and we’ve done it in the past and I suppose this is kind of an obstacle...so if I were to hand that paperwork to a sustainability-minded vegetable production person, they might be overwhelmed by it, they might feel like there’s a lot of questions that don’t apply to them, that they don’t know how to answer appropriately. ...I think you know you have to recognize that that paperwork is meant to cover bases of everything from lab rats and labs and monkeys and [various livestock species]... I think that the institution should have strict guidelines and enforcement of those guidelines and you should document your use of animals and someone centrally should know about it. ...I don’t think they’re unreasonable in those requests, I think it just requires mutual respect and understanding and playing by the rules.”*

It should be noted that IACUCs do have separate regulatory protocols and requirements for livestock used in research and teaching (see *Guide for the Care and Use of Agricultural Animals in Research and Teaching*) despite the responses of some of the participants possibly indicating otherwise (Federation of Animal Science Societies, 2010). Therefore, it is likely that misperceptions of the IACUC regulations may have

contributed to some participants from campus farms and gardens in the United States citing *Animal Ethics Committees* as a challenge or barrier. These misperceptions could have originated from the participants' interpretations of the IACUC regulations or from what the participants were told about these regulations by a secondary source.

Regardless of the likeliness and origins of these misperceptions, I chose to present and interpret the participants' responses as they are in keeping with the qualitative description approach. This allowed me to remain close to the participants' experiences, and to acknowledge their perceptions of *Animal Ethics Committees* as a challenge or barrier of integrating livestock on their campus farms and gardens.

### ***c. Institutional System and Support***

Recall from the literature review that some of the operational difficulties campus farms and gardens face on a day-to-day basis include dealing with institutional bureaucracy, and the lack of institutional and administrative support (Ratasky *et al.*, 2015). This finding was reflected in the results of this study as the post-secondary institutional system and the resultant lack of and/or need to maintain administrative and educational support was discussed as a challenge by seven participants (6 CF1s and CF2-A), each having site-specific responses with regards to this challenge. Some said that it was difficult at first to convince their post-secondary institutions to allow them to integrate livestock on their campus farms and gardens, while others who have the support (administrative and/or educational) find that maintaining it is challenging:

*“...there's a lot of growth and a lot of change in staff positions. So just educating people about what the farm is and what an ecological farm is as things change, and we work in collaboration a lot because the farm is a learning lab, so if you have a lot of turnover in the people you collaborate with, it takes time to build those relationships. So, some of that has been a little bit of a challenge.”* (Participant CF1-J)

*“I would say the faculty connection maybe to some extent, where originally when we started with the layers, there was actually a poultry faculty member on campus who was able to be our advisor [who] didn’t get tenure and left and there was no one for a while.” (Participant CF1-D)*

Like many large organizations, post-secondary institutions are composed of various departments, which specialize in specific areas of teaching and research. As a result, post-secondary institutions can often fall prey to the silo effect, referring to the “...lack of communication and common goals between departments in an organization” (Hotaran, 2009, p. 216). This institutional silo effect was discussed as a challenge and a barrier, particularly from a teaching perspective, by Participant CF2-A who said:

*“...we all live in our little silos and if I were to propose a research program involving say sheep myself, I think the sheep people in the [specific department name] would rightfully kind of say “Hey, that’s our turf, that’s what we do.”. So, I could collaborate with [specific individuals from the department] on a research project, and we have in the past and we do but I guess there’s a little bit of an obstacle there from an instructional perspective rather than research...it’s possible but it’s got its challenges I suppose if it’s just strictly for educational purposes.”*

*Institutional System and Support* was, in fact, the most common barrier mentioned by eight out of the ten participants. Some discussed the difficulties in needing to seek permission and go through the necessary “institutional” channels before making any changes or taking any course of action.

*“...anything that goes up technically has to go through [specified department] so that would be another [barrier]. I think anytime you have more than one department that has to approve something for it to happen makes it significantly more difficult.” (Participant CF4-F)*

Like the experiences of the CF1 participants in the early stages of integrating livestock, several CF4 participants discussed the difficulties of having to convince the administrations of their post-secondary institutions of the value and benefits of integrating livestock on their campus farms and gardens (which is made all the more

difficult at institutions with no agriculture program). And beyond that, some participants discussed the need for educational support and guidance from someone with livestock expertise at the institution.

*“...I think that I might have some barriers convincing the dining halls and my department that they might not be getting any product from the small ruminants but that they’re important to the system and so that might be a barrier as well.”*  
(Participant CF4-G)

*“...the school really wants to separate us from the agriculture school in our state, and so livestock for them is agriculture, so that’s a [barrier] ... they don’t want to put any more into this, they don’t want to grow it because it’s not what the school’s about.”*  
(Participant CF4-F)

*“...we’d need someone qualified and who knows what they’re doing as far as livestock, we’d need someone with some expertise in that area to educate us on how to handle you know the livestock and take care of them...”*. (Participant CF5-B)

However, even if someone with livestock expertise was present, there are other barriers associated with this that can also prevent the integration of livestock. One participant described a barrier that prevents them from integrating a particular livestock species because of a research project at the institution involving the same species:

*“...the farm is located on a large research station and we’re really close to the poultry unit where they do research experiments and because we’re in such close proximity we’re not allowed to have any poultry...they’re really concerned with biological contamination and so there’s a certain perimeter around those that we’re discouraged from.”* (Participant CF4-G)

#### ***d. Need for Public Education***

Related to the ethical challenges of raising livestock for food production is the need to educate the public about livestock in agroecosystems, which is a challenge for four CF1s. The participants discussed educating students, staff, faculty, and community members about the differences between livestock in agroecosystems versus conventional systems, and the roles, value and importance of livestock in sustainable agriculture.

*“It’s more keeping them integrated and helping people understand the value that they’re playing because with movies like “Cowspiracy” and questions around animal agriculture in the U.S. and people that don’t really understand their role in an agroecosystem, we’re always having to help people understand that. ...And I think it’s a good learning moment and for most people, it’s a very honest “Ah ha” moment, livestock actually play a role. And so that’s really our biggest challenge – educating and being able to properly answer difficult questions from students mostly, but staff and faculty as well. (Participant CF1-B)*

The *Need for Public Education*, on the other hand, was only discussed as a barrier by CF5-A who described the “public outcry” that resulted from their attempts to install a mason bee house on their campus farm or garden because members of the community were concerned about bee allergies.

*“...we put a bee condo for mason bees and [there was] an outcry from the community saying “No”. Although they are not stinging bees, [the community] felt threatened – why we didn’t consult them, [why there] was no open house for consultation, all that. So just a simple mason bee house created a bit of panic but I think education will be very important before we can bring any livestock [on] campus.” (Participant CF5-A)*

Given this, it would be safe to assume that any attempts to integrate livestock on CF5-A would prove to be extremely difficult.

#### ***e. Residential Issues***

Three CF1 participants discussed the challenges of integrating livestock in residential areas. Campus farms and gardens, as discussed, are usually located in more densely populated, urban areas at or near their post-secondary institutions. As a result, some campus farms and gardens (like many urban and backyard gardens) are subject to residential zoning by-laws, which either limit the number of livestock they can integrate, or prohibit livestock integration altogether (Schindler, 2012). The participants also said that neighbourhood residents have expressed concerns that the livestock’s proximity to their houses decreases their property values, and some residents have issued noise

complaints. While this may seem inconsequential, Participant CF1-D explained how the residential noise complaints impacted their livestock management decisions and operations:

*“We used a new field the last two years that’s right up against some apartment buildings and there’s one person in the apartment building that absolutely hates the chickens and complained...the roosters are only big enough to crow for maybe two weeks, but [the resident] complained about them incessantly and went all the way to the higher ups in the College...so this year we had to have all hens, we couldn’t have any roosters, which then increased the costs, and decreases [their] productivity ‘cause the hens don’t get as big.”*

The residential barriers of integrating livestock, discussed by five participants (4 CF4s and CF5-B), are the same as those experienced by the three CF1s, although the main barrier is the zoning by-laws that prohibit livestock integration.

*“We thought about chickens because having them on the farm would be an added educational experience for students and community members involved – it would also be exciting for all of the children who participate and second because we would love to include eggs with the CSA, but zoning doesn’t allow it.”* (Participant CF5-B)

## **2. Management Challenges and Barriers**

### ***a. Abattoir and/or End of Life***

Dealing with the end of life issues of raising livestock was mentioned as a challenge by five participants (4 CF1s and CF2-A) whose responses varied depending on the type(s) of livestock they raise (i.e. meat animals vs. non-meat animals), the number(s) of livestock they have, and/or their overwintering management plans. Three of the CF1s that raise meat animals cited specific issues with regards to processing the livestock, echoing some of the challenges of mixed crop-livestock systems discussed by Hilimire (2011). These issues include: the lack of local USDA-certified abattoirs which increases the costs of transporting the livestock for processing, the difficulty in finding abattoirs

that are willing to work with small-scale farms, and the high processing prices at abattoirs that are available.

*“...one of the [challenges] is the lack of a local butcher...I have to drive pretty far...it has to be a USDA-certified facility in order to serve that food in the dining halls.”*  
(Participant CF1-J)

*“...there’s a [specified location] that processes animals. And that’s helpful, but...we have to be at a big enough production level to make it worth their while to do it...they keep raising their price of how much it costs to process our animals.”* (Participant CF1-D)

*“...it’s not a problem that’s specific to [our campus farm or garden], but it’s one that we encountered and that’s the unavailability of small-scale slaughter facilities for livestock and the challenges with finding a place to get a small number of livestock processed.”* (Participant CF1-G)

As for the other CF1 and CF2-A that raise non-meat animals, their participants discussed the difficulties in figuring out what to do with their livestock at the end of their productive lifespan. Campus farms and gardens must approach these end of life decisions with caution because of the ethical concerns of raising livestock for food production (as previously discussed) and the possible repercussions from the public if handled improperly.

*“Another challenge [is] thinking about end of life with [the chickens] and what we were prepared to do with regards to slaughter or not...we came down pretty hard on the idea of not hosting or not participating in animal slaughter as part of our farm education.”* (Participant CF1-C)

*Abattoir and/or End of Life* was not cited as a barrier by any CF4 or CF5 participants.

### ***b. Financial Constraints***

The lack of a secure and constant source of funding is the most common issue that campus farms and gardens face on a daily basis (Leis *et al.*, 2011; Ratasky *et al.*, 2015).

Yet only five CF1 participants discussed the financial challenges associated with integrating livestock on their campus farms and gardens. The participants' responses mainly focused on the high costs of feed, but some mentioned that their limited budgets make it difficult for livestock integration to be a more economically sustainable enterprise.

*"...we can't get to the economies of scale for a lot of livestock-related things for it to quite make sense. ...we don't have the financial position to be able to just do it even if it doesn't make economic sense, just for the educational value and whatnot."*  
(Participant CF1-A)

Similarly, only one CF4 participant mentioned *Financial Constraints* as a barrier to livestock integration.

### **c. Food Safety Regulations**

Food safety is important on any farm that produces food for public purchase and consumption, yet in spite of this, it was only cited as a challenge by two CF1 participants (and not cited as a barrier at all).

*"...when animals are involved, there's higher food safety regulations and not saying they're bad but it is a harder thing to start talking about producing meat or eggs or dairy than vegetables..."* (Participant CF1-A)

Participant CF1-C discussed how food safety regulations impact their livestock management decisions:

*"...the number of days that you must wait between having a [chicken] in a field of annual vegetables and picking fresh produce from that field increased from 90 to 120 days...we oftentimes bring our [chickens] into the agricultural fields toward the end of the season to ensure that we're not having raw manure deposited on our very valuable and in short supply annual ag fields...that regulation affects our freedom of rotating our [chickens] through our annual fields.* (Participant CF1-C)



#### *d. Labour and Logistics*

Regardless of whether one is referring to a campus farm or garden or a privately-owned farm, there are logistics involved in raising livestock for food production – from sourcing livestock from suppliers to providing for their basic needs (i.e. food, water, shelter) – all of which can be challenging.

*“...one of the things is when you have animals that come in the spring and go in the winter, you have to have a source for those. So, sourcing those can sometimes be tricky and you don't know the animals as well as if they were your own herd.”*  
(Participant CF1-J)

Like the crop-livestock agroecosystems that were discussed in the literature review, there are more logistics involved in raising livestock on campus farms and gardens because the livestock are incorporated with crop production in one of the three ways discussed by Hilimire (2011). Thus, challenges arise when the demands of crop and livestock production on campus farms and gardens compete, especially at the height of the growing season (Franzluebbbers, 2007; Hilimire, 2011).

*“...we had this moveable pen but we hadn't actually used it so just getting the hang of how it would move best in the field, how to get the chickens to participate...it was a challenge because it was new to have the livestock here and then actually using the structure that we had built was new.”* (Participant CF1-K)

*“...it took us a little while to get the fencing ordered and the fencing set up and get a structure built for the pigs to shelter them from the sun. ...[the challenge] was setting up the system for the pigs at a time when we're super busy with planting vegetables...”*  
(Participant CF1-G)

A unique logistical challenge associated with raising livestock on campus farms and gardens is ensuring that livestock are cared for every day, including holidays and breaks in the school year. This is especially difficult if no one lives on site.

*“Because we're not a residential facility, having any kind of livestock means that somebody has to be here twice a day, seven days a week.”* (Participant CF1-K)

*“Having animals requires us to have caretakers on site at all times – that’s related to animal [ethics committee] stuff. ...that’s a bit of a challenge – to really provide the year-round, 24-hour care that animals need compared to vegetables...”* (Participant CF1-A)

Inextricably linked with these logistics is the labour required to perform the work. A key component of campus farms and gardens is student labour, and while this can provide beneficial learning experiences for the students, managing livestock on campus farms and gardens becomes more challenging when one must rely heavily on student labour.

*“...we try to do all of our chicken production during the summertime when students aren’t in class because we have more labour availability.”* (Participant CF1-D)

*“...[the students] have really variable skills and changing schedules...while they’re in classes, they can really only do part-time on the farm, so that gives me part-time staff...that has been a [challenge] for sure.”* (Participant CF1-J)

Students generally work part-time to accommodate their course schedules, and at times, their availability can fluctuate depending on their course workloads during the school year, which is a major challenge for campus farms and gardens in general (Ratasky *et al.*, 2015). As per Participant CF1-J, students also come with “variable skills”, and so having to manage all of the various logistics of raising livestock on a campus farm or garden with a limited, part-time, variably skilled labour source is a significant challenge; so much so, in fact, that it was the most common challenge mentioned by all twelve participants.

*Labour and Logistics* was also a common barrier discussed by seven of the ten participants (6 CF4s and CF2-A). Like the CF1 and CF2-A participants, their responses also centred around the lack of stability and permanency in their student labour source

and figuring out the logistics of the daily care and management of the livestock with no one living on their campus farms and gardens.

*“...because we’re at an institution, we’re not there 7 days a week and so in terms of integrating livestock...we have to figure out some sort of a committee of students who live on campus or something like that. And then on the other side...it feels like we’re understaffed still. And so [integrating livestock] might continue to spread us thin, so that could be a drawback.”* (Participant CF4-D)

*“...we only have one staff person and the student turnaround is pretty regular.... So, students who know how the farm operates graduate pretty quickly after they have figured it out, and so we have pretty constant training and having more permanent staff members would ease that [barrier].”* (Participant CF4-C)

Neither participant from CF5-A and CF5-B discussed *Labour and Logistics* because they are encountering other, more significant barriers (see *Space and/or Infrastructure* for CF5-A and *Residential Issues* for CF5-B).

#### ***e. Organic Regulations***

While none of the ten participants discussed *Organic Regulations* as a barrier, two CF1 participants discussed it as a challenge because the regulations can often restrict campus farms and gardens from making certain management decisions that could be more operationally advantageous.

*“...[organic regulations] can sometimes be a challenge...in order to follow organic certification we can have these chickens in this block and then we’ll move them to that block and we’ll be able to conform to whatever regulations are required. But then if it’s really wet or it’s really dry then we may have to find alternate places for the chickens to be. ...so, there can be times where they just have to be out in the grass somewhere away from everything because of how the weather has been.”* (Participant CF1-K)

#### ***f. Quota Regulations***

The Canadian supply management system regulates various economic aspects of dairy, egg (table and broiler hatching), and poultry (chickens and turkeys) production. Its

stated goals (and those of its marketing boards) are to balance the supply of and demand for milk, egg and poultry products so that farmers receive fair-market value for what they produce, processors have a consistent and reliable stream of products to sell, and consumers purchase these products at reasonable and stable prices (Chicken Farmers of Canada, 2017; Heminthavong, 2015). One of the main features of this supply management system is quota, which is a permit or license that a farmer must purchase from an associated agricultural product marketing board within their province (Heminthavong, 2015). Quota limits the amount of a product that a farmer can produce, thereby ensuring the supply management system's producer-processor-consumer balance in the agricultural marketplace. Small-scale farmers can be exempt from the supply management system and quota if they meet their provincial marketing board's exemption criteria, which vary. The British Columbia Egg Marketing Board, for example, states that quota must be obtained for farmers with more than 99 laying hens, whereas the Egg Farmers of Alberta requires farmers with more than 300 laying hens to purchase quota (B.C. Egg, n.d.; Egg Farmers of Alberta, 2017). All farms in Canada, including campus farms and gardens, are required to abide by these supply management regulations. Of the four Canadian campus farm and garden participants in this study (1 CF1, 2 CF4s and 1 CF5), only the CF1 participant cited *Quota Regulations* as a challenge.

### **3. *Physical Site Challenges and Barriers***

#### **a. *Space and/or Infrastructure***

The lack of space and/or infrastructure was a challenge for eight CF1 participants as it prevents them from integrating more livestock on their campus farms and gardens

and/or expanding their current livestock operations to be able to overwinter livestock, for instance. As per Table 4.2, the eight CF1s varied in size, ranging from 0.4 to over 121 hectares, so there did not seem to be a relationship between the size of a campus farm or garden and the participants' responses, which suggests that this challenge is site and operation-specific.

As a barrier, *Space and/or Infrastructure* was mentioned by five participants (4 CF4s and CF5-A). The CF4 participants discussed needing the necessary infrastructure for livestock. However, Participant CF5-A cited not only the lack of physical space but also, more specifically, the lack of a permanent, physical space as the biggest barrier preventing them from integrating livestock. The participant explained:

*“...[CF5-A] has been working [over] the last three years as a [temporary campus farm or garden]. It means that we don't have a permanent space. ...we've stayed in the same place for the last two years and then we moved because in that place now is a new building...we relocated to a new green space but we learned that there's a new building going up there.”*

CF5-A is, as a result, entirely mobile – all beds are contained in boxes on pallets that can be moved when required. This lack of a permanent space would unquestionably be an insurmountable barrier for any campus farm or garden to overcome.

#### ***b. Predators/Urban Animals***

Another common challenge discussed by nine participants (8 CF1s and CF2-A) was issues with predators and urban/domesticated animals. Predation is common on most farms that have livestock and while the participants' responses included the usual suspects – i.e. coyotes, raccoons, foxes, hawks, groundhogs, owls, etc. – some also included dogs, which is likely a result of being located in more populated, urban areas.

*“...some of our biggest predators are people’s personal dogs because we have a fitness trail that runs through the forest and some of that’s adjacent to our farm fields and we’ve had a number of dog attacks where people are not minding the leash law...and so we sadly have that every year and it’s becoming a real issue...”*  
(Participant CF1-B)

In contrast, *Predators/Urban Animals* was only a barrier for Participant CF2-A as they experienced the impacts of predation when livestock were previously integrated, and for Participant CF4-C as they are in the final stages of preparing to integrate livestock.

**c. Proximity and Access**

Four participants (3 CF1s and CF2-A) said that integrating livestock on a campus farm or garden that is not located near main campus and/or that is difficult to access is a challenge in terms of getting students engaged and caring for the livestock (especially if no one lives on site, as discussed in *Labour and Logistics*).

*“Even physical access...we’ve shut the farm down at the end of October and the road to it is not plowed and you’d need 4-wheel drive to even get there...”* (Participant CF2-A)

*“...one of the challenges that we’ve had is how do students get out there, especially students that live in the dorm and don’t have a car. ...there’s a little creek you have to get over and it’s through the woods which for some students...that’s not something they’re used to.”* (Participant CF1-G)

For the same reasons, two CF4 participants (and CF2-A) cited *Proximity and Access* as a barrier, and as per Participant CF4-E, the resultant need for an on-site presence for the livestock may be an institutional requirement.

*“...it’s about 4 miles [from] campus and so not having somebody there overnight with livestock can be challenging”.* (Participant CF4-B)

*“We’re about 7 miles from the central campus and we’re not accessible at this point by any kind of transit. ...I don’t think it’s imperative that someone be with chickens 24 hours a day, but there’s that perception within the administration...”* (Participant CF4-E)

**d. Harsh Weather or Environment**

Integrating livestock in areas with harsh weather or environmental conditions was a challenge for three participants (2 CF1s and CF2-A, also as a barrier) – two said cold winters make it difficult to overwinter livestock, while the Participant CF1-E explained how the hot and dry environmental conditions in their area impact livestock management.

*“...we’re also severely limited by just the characteristics of the desert. We’re moving our irrigation lines twice a day and because of that, it’s really hard to come up with a really good rotation for moving [the livestock] around the fields because every time you move them someplace, all of a sudden they’re in the way of an irrigation line and you have to move them right back off.”* (Participant CF1-E)

## **DISCUSSION OF PHASE II RESULTS**

Table 4.3 summarizes the results of the successes, challenges and barriers of integrating livestock based on the participants’ responses, ranking them from most common to least (as a percentage) out of the twelve participants for the successes and challenges, and the ten participants for the barriers.

With regards to the successes, it is not surprising that all twelve participants said that integrating livestock fulfills the missions of their campus farms and gardens as most, if not all, on-farm/garden activities and initiatives should align with these mission statements. The reasons that the participants provided to explain their responses showed little variation. The social successes of livestock integration (i.e. providing unique experiential learning and skill building opportunities for students, engaging both students and community members, etc.) were the most common reasons mentioned by all of the participants, given that the missions of the campus farms and gardens are educationally focused. The majority of the participants also discussed the ecological successes (via ecological services) of integrating livestock, and participants whose

campus farms and gardens could reap the economic successes of livestock integration discussed them as well. Many of the ecological and economic successes mentioned by the participants were the ecological and economic advantages of livestock-integrated agroecosystems as outlined in the literature review.

RANK	SUCCESSSES	CHALLENGES	BARRIERS
1	Social (Experiential Learning, Engagement)	Labour and Logistics	Institutional System and Support
2	Ecological (Ecological Services)	Predators/Urban Animals	Labour and Logistics
3	Economic (Revenue Generation, Diversification)	Space and/or Infrastructure	Space and/or Infrastructure
4		Institutional System and Support	Residential Issues
5		Ethical Concerns	Animal Ethics Committees
6		Financial Constraints	Proximity and Access
7		Abattoir and/or End of Life	Predators/Urban Animals
8		Animal Ethics Committees	Ethical Concerns
9		Need for Public Education	Need for Public Education
10		Proximity and Access	Abattoir and/or End of Life
11		Residential Issues	Financial Constraints
12		Harsh Weather or Environment	Harsh Weather or Environment
13		Food Safety Regulations	
14		Organic Regulations	
15		Quota Regulations	

**Table 4.3:** The successes, challenges and barriers of integrating livestock from most common (i.e. highest ranked) to least.

In contrast, there was a great deal of variation among the participants' responses of the challenges and barriers of integrating livestock. Based on the results of the fifteen challenges, the most common (i.e. the highest ranked) are: *Labour and Logistics*, *Predators/Urban Animals*,



*Space and/or Infrastructure, Institutional System and Support* and *Ethical Concerns*. As for the barriers, the most common out of the eleven are: *Institutional System and Support, Labour and Logistics, Space and/or Infrastructure, Residential Issues* and *Animal Ethics Committees*. While these rankings could indicate the impact and/or significance of these challenges and barriers among the campus farms and gardens, it is important to consider the factors that contribute to the variation in the participants' responses before interpreting the results.

### ***Applicability of the Challenges and Barriers***

The first factor to consider is that some of these challenges and barriers are not applicable to all campus farms and gardens and must be accounted for in the data. But defining the parameters of applicability can be difficult. For example, if a participant said that they do not have to contend with harsh weather or environmental conditions, does that mean that the *Harsh Weather or Environment* challenge or barrier is not applicable to them? Or does it simply mean that it is not a challenge or a barrier for them? *Proximity and Access* is another example of a challenge or barrier that may not be applicable to a campus farm or garden that is near main campus compared to one that is far from campus. However, "near" and "far" are relative terms, so what might be considered "near" for some, might be "far" for others, or vice versa. These subjective and relative aspects make it difficult to define the parameters of applicability for some of the challenges and barriers mentioned by the participants, which I acknowledge here in this discussion. Fortunately, the applicability of some of the challenges and barriers can be more objectively defined.

The *Animal Ethics Committees, Organic Regulations* and *Quota Regulations* challenges and barriers are not applicable to all campus farms and gardens because they involve an

association with and oversight from a specific regulatory body or organization. Recall that as a challenge, *Animal Ethics Committees* was only mentioned by four of twelve participants ( $4/12 = 33\%$ ), but only six of the twelve campus farms and gardens are associated with post-secondary institutions that have these Committees. One of the two participants who did not mention this as a challenge was Participant CF1-I whose campus farm or garden would not likely be bound by its animal ethics committee's regulations since it was a privately-owned farm at the time of the interview. Therefore, the *Animal Ethics Committees* challenge was only applicable to five campus farms and gardens ( $4/5 = 80\%$ ). As a barrier, *Animal Ethics Committees* was mentioned by four of the ten participants ( $4/10 = 40\%$ ), but it was only applicable to nine campus farms and gardens ( $4/9 = 44\%$ ). Likewise, *Organic Regulations*, which was cited by two participants as a challenge, was only applicable to seven campus farms and gardens (four that are certified organic and three that are in transition); and *Quota Regulations* was only applicable to (and a challenge for) the one campus farm or garden in Canada that is currently integrating livestock.

Tables 4.4 and 4.5 summarize the participants' responses of the challenges and barriers (respectively) of integrating livestock, and show the frequency of responses for each challenge and barrier. The shaded cells indicate that *Animal Ethics Committees*, *Organic Regulations* and *Quota Regulations* were not applicable to the campus farms and gardens, and the total numbers of applicable responses were adjusted accordingly. The percentages in the last row of Tables 4.4 and 4.5 represent the proportion of the applicable participant responses for each challenge and barrier – the higher the percentage, the more common a challenge (or a barrier) is among campus farms and gardens to which the challenge (or barrier) was applicable.

Participant Code	Stage of Livestock Integration (in years)	INSTITUTIONAL CHALLENGES					MANAGEMENT CHALLENGES						PHYSICAL SITE CHALLENGES			
		Ethical Concerns	Animal Ethics Committees	Institutional System and Support	Need for Public Education	Residential Issues	Abattoir/ End of Life Issues	Financial Constraints	Food Safety Regulations	Labour and Logistics	Organic Regulations	Quota Regulations	Space and/or Infrastructure	Predators/ Urban Animals	Proximity and Access	Harsh Weather and Environment
CF1-A	> 10 years	x	x					x	x	x	x	x	x			
CF1-B	> 100 years	x		x	x					x			x	x		
CF1-C	6 years	x	x			x	x	x	x	x			x	x	x	
CF1-D	6 years		x	x	x	x	x	x		x				x		
CF1-E	> 100 years	x		x				x		x			x	x		x
CF1-F	59 years	x			x					x			x	x		x
CF1-G	< 1 year			x			x			x					x	
CF1-H	< 1 year									x				x	x	
CF1-I	2 years	x		x						x			x			
CF1-J	5 years			x	x	x	x			x			x	x		
CF1-K	13 years	x						x		x	x		x	x		
CF2-A	4 years		x	x			x			x				x	x	x
<b>Frequency of Participants' Responses</b>		7	4	7	4	3	5	5	2	12	2	1	8	9	4	3
<b>Total Number of Applicable Responses</b>		12	5	12	12	12	12	12	12	12	7	1	12	12	12	12
<b>Proportion of Applicable Participant Responses (%)</b>		<b>58%</b>	<b>80%</b>	<b>58%</b>	33%	25%	42%	42%	17%	<b>100%</b>	29%	<b>100%</b>	<b>67%</b>	<b>75%</b>	33%	25%

**Table 4.4:** The challenges of integrating livestock as per the CF1 and CF2-A participants.

Participant Code	Stage of Livestock Integration	INSTITUTIONAL BARRIERS					MANAGEMENT BARRIERS						PHYSICAL SITE BARRIERS			
		Ethical Concerns	Animal Ethics Committees	Institutional System and Support	Need for Public Education	Residential Issues	Abattoir/ End of Life Issues	Financial Constraints	Food Safety Regulations	Labour and Logistics	Organic Regulations	Quota Regulations	Space and/or Infrastructure	Predators/ Urban Animals	Proximity and Access	Harsh Weather and Environment
CF2-A	Prior history		x	x			x			x				x	x	x
CF4-A	Early			x						x			x			
CF4-B	Early			x									x		x	
CF4-C	Final	x	x			x				x				x		
CF4-D	Early					x		x		x			x			
CF4-E	Inquiry		x	x		x				x					x	
CF4-F	Inquiry		x	x		x				x						
CF4-G	Inquiry			x						x			x			
CF5-A	Early			x	x								x			
CF5-B	Early			x		x										
<b>Frequency of Participants' Responses</b>		1	4	8	1	5	1	1	0	7	0	0	5	2	3	1
<b>Total Number of Applicable Responses</b>		10	9	10	10	10	10	10	10	10	5	3	10	10	10	10
<b>Proportion of Applicable Participant Responses (%)</b>		10%	<b>40%</b>	<b>80%</b>	10%	<b>50%</b>	10%	10%	0%	<b>70%</b>	0%	0%	<b>50%</b>	20%	30%	10%

**Table 4.5:** The barriers of integrating livestock as per the CF2-A, CF4, CF5-A and CF5-B participants.

As shown in Table 4.6, the rankings of the barriers were unaffected by the applicability factor, but the challenges were, particularly among the top three rankings. *Animal Ethics Committees* becomes the 3<sup>rd</sup> highest ranked challenge (formerly 8<sup>th</sup>), while *Quota Regulations* becomes one of the highest ranked challenges (formerly 15<sup>th</sup>), despite the fact that it was only a challenge for one campus farm or garden.

RANK	SUCSESSES	CHALLENGES	BARRIERS
1	Social (Experiential Learning, Engagement)	Labour and Logistics	Institutional System and Support
2	Ecological (Ecological Services)	<b>Quota Regulations</b>	Labour and Logistics
3	Economic (Revenue Generation, Diversification)	<b>Animal Ethics Committees</b>	Space and/or Infrastructure
4		Predators/Urban Animals	Residential Issues
5		Space and/or Infrastructure	Animal Ethics Committees
6		Institutional System and Support	Proximity and Access
7		Ethical Concerns	Predators/Urban Animals
8		Abattoir and/or End of Life	Ethical Concerns
9		Financial Constraints	Need for Public Education
10		Need for Public Education	Abattoir and/or End of Life
11		Proximity and Access	Financial Constraints
12		<b>Organic Regulations</b>	Harsh Weather or Environment
13		Residential Issues	
14		Harsh Weather or Environment	
15		Food Safety Regulations	

**Table 4.6:** The successes, challenges and barriers of integrating livestock, after accounting for the applicability factor.

By re-presenting the data in this way, I am not necessarily suggesting that greater impact or importance be placed on the *Animal Ethics Committees*, *Organic Regulations* and/or *Quota*

*Regulations* challenges as a result of their altered rankings. I am merely attempting to illustrate that the applicability of the challenges and barriers (particularly those that are associated with regulatory bodies or organizations) contributes to the variation among the participants' responses and should be taken into consideration when interpreting the results.

### ***The Uniqueness of Campus Farms and Gardens***

The second factor to consider is the uniqueness of campus farms and gardens. The systems analyses of the 22 campus farms and gardens revealed that while their goals (i.e. their missions) may be similar in terms of their educational mandates, their physical and perceptual boundaries, and their biological/physical and socio-economic components vary greatly, which confirmed what I noticed during my preliminary research of campus farms and gardens. The data in Table 4.2 (presented earlier in this chapter), while not exhaustive of all the boundaries and components from the systems analyses I performed, shows the variation among the participating campus farms and gardens, not only in size and in the species and numbers of livestock, but also in the types and amounts of paid and unpaid labour. The resultant interactions between the various boundaries and components and between the components themselves make campus farm and garden systems unique and, more importantly, complex.

On a broader scale, the analyses also revealed that campus farms and gardens are affiliated with different types of post-secondary institutions – a fact that also contributes to their unique nature. Although the specific types were purposely not listed in Tables 4.2, 4.4 or 4.5 to preserve the anonymity of the participants, the affiliated institutions were either colleges (work, liberal arts and other) or land-grant/research universities. An analysis of the types of post-secondary institutions and the challenges and barriers associated with each type revealed no

specific patterns or trends, suggesting that an affiliation with a certain type of institution has no association with the types of challenges a campus farm or garden experiences or barriers it encounters. In addition, it was evident during the interviews that the relationships between the campus farms and gardens and their post-secondary institutions also varied, irrespective of the specific type of institution that they were affiliated with. Some campus farms and gardens are more formally incorporated into their post-secondary institutions' academic and community programming, while others are less formally incorporated, which likely explains why there was no correlation between the types of post-secondary institutions and the types of challenges experienced or barriers encountered by campus farms and gardens.

The uniqueness of campus farms and gardens can also be attributed to the fact that they are at different stages of integrating livestock. Some CF1s, for instance, have been integrating livestock for over 100 years, while others just began less than a year ago. Similarly, some CF4s are in the early stages of thinking about integrating livestock, while one CF4, as discussed, is in the final stages of approval. The "Stage of Livestock Integration" column in Table 4.4 indicates how long CF1s have been integrating livestock (and how long CF2-A had integrated livestock). An examination of the types of challenges experienced by CF1s that have been integrating livestock for many years compared to those experienced by CF1s that began recently showed only one similarity: all CF1s mentioned *Labour and Logistics* as a challenge. Most CF1s that have been integrating livestock for 5 years or longer mentioned *Space and/or Infrastructure*, *Predators/Urban Animals* and *Ethical Concerns* more frequently than the other challenges. In contrast, most CF1s that have been integrating livestock for less than 2 years cited *Institutional System and Support* and *Proximity and Access* most frequently among their challenges. In Table 4.5, the "Stage of Livestock Integration" column indicates how far along the CF4s and CF5s

(and CF2-A) are in planning or preparing to integrate livestock. The stages are defined as follows: 1) Prior History – for CF2-A only; 2) Early – preliminary stages of conceptualizing; 3) Inquiry – planning stages and making inquiries; and 4) Final – awaiting final approval/preparing for livestock integration. The most frequently mentioned barrier among CF4s that are in the Final and Inquiry stages of integrating livestock was *Labour and Logistics*, whereas *Institutional System and Support* and *Space and/or Infrastructure* were barriers mentioned by CF4s in the Early stage. Both results suggest that the types of challenges differ depending on how long the campus farm or garden has been integrating livestock, and so too do the types of barriers depending on how far along the campus farm or garden is in planning or preparing to integrate livestock.

## **REVISITING THE RESULTS OF PHASE II**

Having factored in the applicability of the more “objective” challenges and barriers, recognizing that there are some subjective and relative elements that are difficult to account for, and having considered the uniqueness of campus farms and gardens (from their systems’ complexities, to their relationships and affiliations with their post-secondary institutions, to the stages they are in with respect to integrating or wanting to integrate livestock), how can the results be interpreted? Perhaps the answer to this question is that the results require little interpretation – that the challenges and barriers of integrating livestock are listed in Table 4.6 and the variation in the participants’ responses is due to the applicability factor and the uniqueness of campus farms and gardens. But perhaps an alternative interpretation can be found if the results are viewed from a different perspective.



Up to this point, the challenges and barriers of integrating livestock have been treated and discussed separately since they are respectively experienced and encountered by two different groups of participants: campus farms and gardens that are currently integrating (or had integrated) livestock, and those that are wanting to integrate livestock. However, it is interesting that the participants' responses of the challenges and barriers of integrating livestock on campus farms and gardens are the same, with the exception of there being fewer management barriers. More specifically, all of the Institutional and Physical Site challenges and barriers were the same, along with three of the Management challenges and barriers: *Labour and Logistics*, *Financial Constraints* and *Abattoir/End of Life*. Given this, it is possible that an alternative interpretation of the results lies in finding similarities among the most common challenges and barriers.

<b>RANK</b>	<b>SUCCESSSES</b>	<b>CHALLENGES</b>	<b>BARRIERS</b>
<b>1</b>	Social (Experiential Learning, Engagement)	<b>Labour and Logistics</b> <i>(Quota Regulations)</i>	<b>Institutional System and Support</b>
<b>2</b>	Ecological (Ecological Services)	<b>Animal Ethics Committees</b>	<b>Labour and Logistics</b>
<b>3</b>	Economic (Revenue Generation, Diversification)	Predators/Urban Animals	<b>Space and/or Infrastructure</b>
<b>4</b>		<b>Space and/or Infrastructure</b>	Residential Issues
<b>5</b>		<b>Institutional System and Support</b>	<b>Animal Ethics Committees</b>
<b>6</b>		Ethical Concerns	Proximity and Access

**Table 4.7:** The most common successes, challenges and barriers of integrating livestock.

Table 4.7 lists the successes, and the five/six most common challenges and barriers after accounting for the applicability of *Animal Ethics Committees*, *Organic Regulations* and *Quota Regulations*<sup>10</sup>. The similar responses among the challenges and barriers (in boldface) are: *Labour and Logistics*, *Institutional System and Support*, *Animal Ethics Committees*, and *Space*

<sup>10</sup> The *Quota Regulations* challenge was not factored into the 1<sup>st</sup>/2<sup>nd</sup> ranking given that it was only mentioned by the one campus farm or garden to which it was applicable. It was included in Table 4.7 for reference.

*and/or Infrastructure*. Considering that these are common challenges and barriers among campus farms and gardens that are currently integrating and wanting to integrate livestock, I would argue that *Labour and Logistics*, *Institutional System and Support*, *Animal Ethics Committees*, and *Space and/or Infrastructure* are the challenges/barriers that need to be addressed to facilitate (or to continue to facilitate) livestock integration on campus farms and gardens.

In making this somewhat bold statement, I am not negating the impact or significance of the other challenges and barriers that were mentioned as I recognize that they may be more impactful or significant to some campus farms and gardens than to others. However, by addressing the challenges/barriers that impact the majority of campus farms and gardens, livestock integration can be facilitated on more sites.

Furthermore, during my analysis of the interview transcriptions, I noticed connections between some of the most and least common challenges/barriers. For example: *Proximity and Access*, if you recall, is a challenge/barrier for participants whose campus farms and gardens are located several miles away from main campus. Because of this, the participants said that integrating livestock requires someone to either live on the campus farm or garden, or to go to the site to care for and manage the livestock every day (including holidays and breaks in the school year), which is a *Labour and Logistics* challenge/barrier. Resolving the *Labour and Logistics* challenge/barrier in this case by seeking institutional approval for and hiring a live-in caretaker, or by hiring more permanent staff to manage the livestock year-round may, in turn, subsequently alleviate the *Proximity and Access* challenge/barrier. Another example is the connection between *Institutional System and Support* and *Financial Constraints*. As per the participants' responses, one of the most common Institutional challenges/barriers is the lack of

and/or need for more educational and administrative support. Providing more support to, and making stronger institutional connections and associations with campus farms and gardens that are integrating or wanting to integrate livestock can potentially increase student engagement and enrollment, resulting in increased revenues from student tuition fees and/or relevant grants and donations. A portion of these revenues can then be allocated to the campus farms and gardens' budgets, thus alleviating some of the *Financial Constraints* associated with integrating or wanting to integrate livestock. These examples show that by addressing the most common challenges/barriers, it is possible to subsequently address some of the other least common challenges/barriers as well via these connections, thereby facilitating livestock integration on campus farms and gardens.

## **COMPARISON OF PHASE I AND PHASE II RESULTS**

A comparison of the successes and challenges I experienced in integrating livestock at the UBC Farm (Phase I) with the results of Phase II revealed many similarities. In terms of the successes, the ways in which the integration of the cattle and chickens fulfilled the goal areas of the UBC Farm's mission (as outlined in Chapter 2) were the social successes of integrating livestock discussed by the participants. First, integrating livestock on campus farms and gardens provided students (i.e. myself and those from the participants' post-secondary institutions) with unique, hands-on experiential learning opportunities that enhanced classroom instruction and imparted various agricultural and transferable skills. It also served as a means to attract and engage students to be involved with their campus farms and gardens through self-directed projects, course work, and other activities that stimulated their personal and/or academic interests. Finally, integrating livestock on campus farms and gardens in Phases I and II exposed

the public (both students and community members) to alternative, agroecological methods of livestock production, which provided opportunities to discuss relevant issues such as the current methods of livestock production in our food system, and the ethics of raising livestock for food production overall. As for the ecological successes, the long-term ecological impacts of the cattle and chickens were not measurable given the project's short, three-month timeframe. However, the short-term ecological impacts were observable, (such as the conversion of forage and feed into manure and the return of nutrients within the manure to the soil via nutrient cycling), and these coincided with some of the ecological successes mentioned by the participants in Phase II. The only difference between my experience and that of the participants with regards to the successes was that my project did not generate revenue through the sale of animal-based food products, nor did it diversify the UBC Farm's enterprises because it was beyond the scope of Phase I to do so.

Compared to the four common challenges/barriers, the challenges that I experienced were mostly *Labour and Logistics* issues associated with the need for more labour support and the project's delays due to difficulties in managing the cattle. However, my main challenge was the Animal Care Committee application and approval process, not just because of the delays that it caused, but more so because I found that the questions on the application lacked relevancy and applicability to my research objectives at the UBC Farm. Several participants in Phase II also cited this as a major issue in their discussions of the *Animal Ethics Committees* challenge/barrier.

During Phase I, I did not consider the lack of space and/or infrastructure as a challenge, even though I was limited in space by the dimensions of Field D3-1 and I did not have a shelter for the chickens. I saw it, rather, as an opportunity for myself to learn how to design a rotational grazing system within Field D3-1 and to construct a functional, lightweight, mobile chicken

shelter using PVC pipes. It was also an opportunity for the Civil Engineering students to learn how to (and more importantly, how not to) design and construct a mobile chicken shelter.

Though, as I mentioned in Chapter 2, the size of the paddocks in my rotational grazing system possibly contributed to some of the management challenges I experienced with the cattle. So, in some ways, *Space and/or Infrastructure* was also a challenge for me.

As for the *Institutional System and Support* challenge/barrier, I did not experience a lack of or need for more institutional support, nor any negative effects of the institutional system at UBC likely because the integration of the cattle and chickens was a temporary student project as opposed to a permanent component of the UBC Farm's operations. Perhaps the *Institutional System and Support* challenge/barrier (along with some of the other challenges/barriers mentioned in Phase II) would have been more evident had I continued with the project for more than three months and/or over multiple seasons.

The similarities between the successes and challenges of integrating livestock that I experienced in Phase I and the successes and challenges/barriers that other campus farm and garden participants experienced in Phase II further support the findings and the interpretation of the results in this chapter. Therefore, *Labour and Logistics*, *Institutional System and Support*, *Animal Ethics Committees*, and *Space and/or Infrastructure* are the challenges/barriers that need to be addressed to facilitate (or to continue to facilitate) livestock integration on campus farms and gardens in order for them to reap the social, ecological and/or economic successes associated with it.

## **CHAPTER 5: SUMMARY AND CONCLUSIONS**

### **INTRODUCTION**

In this final chapter, I will summarize the findings from Phases I and II, discuss how the knowledge obtained from this study can help to address some of the challenges and barriers of integrating livestock on campus farms and gardens, and provide directions for future research in this area.

### **SUMMARY OF FINDINGS FROM PHASES I AND II**

The purpose of this study was to determine the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States through my own experience in integrating cattle and chickens at the UBC Farm (Phase I) and through a series of in-depth interviews with representatives from campus farms and gardens that are currently integrating, had integrated and/or are wanting to integrate livestock on their sites (Phase II). Based on the results, the integration of livestock fulfilled the respective missions of all campus farms and gardens in Phases I and II by providing experiential learning, skill building and engagement opportunities for students, and public demonstrations of alternative, agroecological approaches of livestock production as a means of generating discussions about current livestock production systems and ethical concerns of raising livestock for food production (social successes). The results also showed that the integration of livestock provided the majority of campus farms and gardens with ecological services, such as nutrient cycling and pest management (ecological successes); and for some, economic diversification and additional revenue through the sale of animal-based food products (economic successes).

Nevertheless, livestock integration on these campus farms and gardens was not without its difficulties. The CF1 and CF2-A participants discussed fifteen different challenges pertaining to the general management of livestock, and to their campus farms and gardens' physical site or space and affiliations with their respective post-secondary institutions. Similarly, the CF2-A, CF4, CF5-A and CF5-B participants discussed eleven barriers, which were all cited as challenges by the CF1 (and CF2-A) participants. The variation among these challenges and barriers was due to two factors: 1) the applicability of the challenges and barriers to the campus farms and gardens, particularly those that involve an association with and oversight from a regulatory body or organization, and 2) the uniqueness of the campus farms and gardens in terms of their systems' distinct boundaries, components and interactions; their affiliations with and roles within their post-secondary institutions; and their current stage of livestock integration. While the participants' responses can be interpreted simply as they are, the fact that the barriers encountered by campus farms and gardens that are wanting to integrate livestock are also the challenges experienced by those that are currently integrating (or had integrated) livestock suggests another possible interpretation. A comparison of the challenges and barriers that were most frequently discussed by the participants revealed four common responses: *Labour and Logistics, Institutional System and Support, Animal Ethics Committees, and Space and/or Infrastructure* (three of which I also experienced during Phase I). Further analysis suggests that addressing these four challenges/barriers will help to facilitate (or to continue to facilitate) livestock integration on a majority of campus farms and gardens and may also resolve some of the other least common challenges/barriers that are connected with them. Facilitating livestock integration would allow campus farms and gardens to take advantage of the ecological and economic successes associated with livestock-integrated agroecosystems. But, more

importantly, it would allow campus farms and gardens to provide students, especially those in agricultural education, with the kinds of unique experiential learning and skill building opportunities that will enhance their classroom learning, stimulate their academic and personal interests, and motivate them to become more involved with their campus farms and gardens and potentially discover career paths that they would never have imagined for themselves.

## **RECOMMENDATIONS TO ADDRESS CHALLENGES/BARRIERS**

Addressing the *Labour and Logistics*, *Institutional System and Support*, *Animal Ethics Committees*, and *Space and/or Infrastructure* challenges/barriers can be difficult because there are some aspects about them that are simply unavoidable. For instance, there are more logistics (and labour) involved in managing livestock, and campus farms and gardens generally need to do so within the confines of their physical space and available infrastructure. Also, their affiliations with their post-secondary institutions require campus farms and gardens to seek permission and to go through the necessary institutional channels prior to taking any course of action, such as integrating livestock, which must be overseen by their institutional animal ethics committees (if applicable). However, these challenges/barriers can still be made less impactful by implementing some of the following recommendations.

For *Labour and Logistics*, the difficulty for most campus farms and gardens was in coordinating the daily management of livestock, especially during holidays and school breaks, with a variably skilled, part-time, and transitional student labour source. While having a live-in caretaker would mimic a privately-owned farm and alleviate some of these difficulties, as well as any potential concerns that post-secondary institutions may have about not having an on-farm presence to monitor the livestock, I recognize that this is not an option for many campus farms



and gardens. As an alternative recommendation, Participant CF2-A suggested to “*invoke [the use of] technology*”.

*“I actually did buy an automated chicken coop door that opens and closes in response to light and actually has the capacity to connect to the internet and send you a text message or make a Twitter post every time the door closes. But even if there was some kind of app where we could check in personally, like when the person closes the door they post it on this app and then I would get an email if it doesn’t happen or something like that.”*

Using these or other forms of technology (i.e. cameras, monitoring equipment, etc.) might help to address (or, at the very least, alleviate) the *Labour and Logistics* challenge/barrier.

Obtaining and maintaining institutional support (both administrative and educational) was essential for campus farms and gardens that are integrating or wanting to integrate livestock. This challenge/barrier is only magnified by the lack of communication and collaboration between departments and faculties within many post-secondary institutions (referred to as the silo effect in Chapter 4). While these departmental and faculty divisions make sense from an organizational standpoint, this silo effect can potentially hinder opportunities to enhance student learning and engagement via the integration of livestock due to the lack of interdisciplinary and transdisciplinary collaborations between departments and/or faculties. Institutional support for campus farms and gardens, particularly administrative support, cannot be forced. But perhaps the onus is on campus farm and garden representatives to try and obtain educational support for livestock integration on their sites by finding ways to collaborate with other departments and/or faculties within their respective post-secondary institutions. If these collaborations result in positive and impactful educational experiences for students, then perhaps administrative support from the institutions will follow.

With respect to *Animal Ethics Committees*, my first recommendation would be for clearer communication between IACUCs and campus farms and gardens, and/or more instruction from IACUCs on the regulations and protocols for integrating livestock on campus farms and gardens in order to resolve (and prevent) any misperceptions or misunderstandings. The regulations and protocols enforced by animal ethics committees in Canada, however, are still based on traditional, laboratory research and are not applicable to integrating livestock on campus farms and gardens. Therefore, my second recommendation would be for Canadian animal ethics committees to create separate protocols for livestock used for teaching and demonstration purposes on campus farms and gardens.

Finally, many of the participants said that they were interested in participating in this study because they wanted to connect with and learn from other campus farms and gardens that are also integrating or wanting to integrate livestock. Participant CF4-C, for instance, said that they learned many hard and valuable lessons over the last two years in preparing to integrate livestock on CF4-C (specifically with regards to overcoming some of the institutional barriers they encountered), and they wanted to find some way of sharing this information so that others would not have to go through the same hardships. The establishment of a campus farm and garden network, while not directly addressing one of the four challenges/barriers, will allow information and experiences, like Participant CF4-C's, to be shared and discussed, which may potentially address some of the challenges and barriers of integrating livestock. It is my hope that this thesis can serve to disseminate some of this information to the participants of this study and representatives of other campus farms and gardens, and to support the creation and establishment of this network.

## **DIRECTIONS FOR FUTURE RESEARCH**

As explained in Chapter 3, the limitations of Phase II likely resulted in lower participation rates, and although the findings of this study were derived from my experience in Phase I and the participants' experiences in Phase II, further research to support these findings would be beneficial, especially given the variation among the challenges and barriers. One suggestion would be to send a follow-up survey to campus farm and garden representatives listing the challenges and barriers found in this study (along with a brief description of each one), and asking them to select those that they are experiencing and/or encountering. An "Other" option with a blank, fillable field should also be included in case the challenges they are experiencing or barriers they are encountering are not listed. This survey would be a means of methodological triangulation and would serve to confirm the findings in this study, and improve one's understanding of the challenges and barriers of integrating livestock on campus farms and gardens (Bekhet & Zauszniewski, 2012).

In the discussion of the factors that contributed to the variation among the challenges and barriers cited by the participants in Phase II, the results suggested that the types of challenges and barriers campus farms and gardens experience and encounter respectively differ depending on what stage they are in with regards to integrating livestock (i.e. the "Stage of Livestock Integration" in Tables 4.4 and 4.5). However, because there were only twelve campus farm and garden participants that spoke of the challenges in Phase II, and ten that spoke of the barriers, it was difficult to find any specific patterns or trends within the data. A possible direction for future research, therefore, would be to expand on this to see what types of challenges campus farms and gardens experience and what types of barriers they encounter at various stages of livestock integration. This would potentially provide some guidance to campus farms and

gardens that are just starting to integrate livestock so they can anticipate possible challenges in the future, or to those that are wanting to integrate livestock but are not sure where to begin.

This study focused on alleviating challenges/barriers to facilitate livestock integration on campus farms and gardens. Though, reflecting on my experience, I was introduced to and inspired by the concept of integrating livestock at the UBC Farm through a pre-requisite course that I took as a pre-veterinary student. This course was taught by Art Bomke, who presented me with the opportunity to integrate cattle at the UBC Farm and introduced me to Harold Steves, who generously provided the necessary training and Belted Galloways for the pilot project in 2010 and for Phase I in 2011. Had it not been for Agroecology 260, for Art, and for a community partnership with Harold Steves, it is safe to say that I would not have had the life-changing experience of integrating cattle and chickens at the UBC Farm, nor would I have set out to answer the research questions in this thesis. And so, another direction for future research would be to look into how facilitators, such as undergraduate and graduate level courses, course instructors, community partnerships, and livestock training programs at post-secondary institutions and within local communities, play a role in livestock integration on campus farms and gardens.

## **CONCLUDING REMARKS**

As mentioned in Chapter 3, all participants were asked if the integration of livestock has benefited or would benefit their campus farms and gardens (or campus farms and gardens in general for Participant CF5-C); and everyone, including Participant CF5-C, said “Yes”. When asked why, they all cited the same social, ecological and economic successes of integrating livestock discussed in this study. This was not surprising coming from CF1 and CF2-A

participants, but the fact that CF4 and CF5 participants also cited the same prospective successes is quite telling. But as the old adage says: there are two sides to every story.

As evidenced by the *Ethical Concerns* challenge/barrier, there are people who are vehemently opposed to raising livestock for food production, and integrating livestock on campus farms and gardens may be seen by these individuals as perpetuating this practice, despite its social (educational), ecological and economic benefits. However, post-secondary institutions are places where various perspectives and opinions can be discussed and respectfully debated, where knowledge can be shared and disseminated, and where mutual understandings can be forged. Many of the CF1 participants who experienced the *Ethical Concerns* challenge said that they are always prepared and open to answering questions and addressing concerns that their students and/or the public may have about their livestock production practices. Therefore, campus farms and gardens, like their post-secondary institutions, can also be places where both sides of the story on raising livestock for food production can be heard.

Regardless of which story one identifies with, it is clear from the findings of this study that there are several challenges/barriers that oppose or prevent campus farms and gardens from reaping the full extent of the social, ecological and economic successes associated with livestock integration. Therefore, by addressing some of the most common challenges/barriers presented in this thesis, perhaps more stories of integrating livestock on campus farms and gardens will have happier endings.

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## APPENDIX A: PHASE I – ADDITIONAL PHOTOS



**Photos:** The cattle's first graze in Paddock 1 (top row, left); chicken paddock set up (top row, right); chickens at work (middle row, left); cattle and chickens in the rotation (middle row, right); forage regrowth in Paddock 1 (bottom row, left); forage regrowth in Paddocks 1 (furthest away) through 5 (bottom row, right).

## **APPENDIX B: PHASE II – SURVEY (PART 1) AND INTERVIEW QUESTIONS (PART 2)**

### **PART 1: SURVEY OF CAMPUS FARMS AND GARDENS:**

#### **PROJECT: The Successes, Challenges and Barriers of Integrating Livestock on Campus Farms and Gardens at Post-Secondary Institutions in Canada and the United States**

This brief survey is the first part (Part 1) of a two-part study on the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States.

For the purpose of this study, campus farms and gardens are defined as sites that:

- Grow/produce (and possibly sell) some type(s) of field and/or horticulture crop(s).
- Operate at, by people affiliated with, and/or in partnership with a post-secondary educational institution (i.e. a college or a university) in Canada or the United States.
- Are run by students of the post-secondary institution (as part of a student organization, group or club), and/or for students of the post-secondary institution (through academic course work, self-directed projects, leadership and/or volunteer opportunities, part-time and/or full-time employment, etc.).
- Have some type of learning component, whether it be for the students of the post-secondary institution, the part-time or full-time employees of the campus farm or garden, and/or for the community members that are involved with the campus farm or garden in some capacity.
- May or may not have livestock.

This survey is intended to be completed by a campus farm or garden director, manager or designate who holds a position of authority or leadership.

The questions in this survey will ask you to provide general information about your campus farm or garden (i.e. size, types of crops grown, etc.) and, more specifically, about integrating (i.e. “having”) livestock on your campus farm or garden. (NOTE: Your campus farm or garden DOES NOT need to have livestock in order for you to participate in this study.) The survey will take 5 to 10 minutes to complete.

Most of the general information provided in this survey will be compiled and presented in the form of a directory of campus farms and gardens at post-secondary institutions in Canada and the United States. This directory will serve to consolidate and provide updated information about campus farms and gardens in order to assist in the foundation of a campus farm and garden network in Canada and the United States.

The directory will be published in Natalie Yuen's (the Co-Investigator) Master's thesis, which will be made publicly available through cIRcle (the University of British Columbia's digital

repository for research and teaching materials), and may be published in a peer-reviewed agricultural journal in the near future. If you require authorization from your post-secondary institution before providing information in this survey that will be published about your campus farm or garden, please seek the necessary permissions.

As an incentive for participating in this survey, your campus farm or garden will be entered into a draw to receive a set of books related to agriculture and/or livestock welfare, care and handling in agricultural systems. The draw will occur in late-October or November 2016.

By completing this survey, you are consenting to participate in Part 1 of this study.

Would you like to proceed with the survey?            YES            or            NO

1. Please provide your full name (optional) and your position title/role at your campus farm or garden.
2. What is the name of your campus farm or garden (please avoid using acronyms)?
3. Where is your campus farm or garden located (City, Province/State)?
4. Please provide general contact information (email address and/or phone number) for your campus farm or garden.
5. Does your campus farm or garden have a website or Facebook page? If so, please include the URLs below.
6. What is the full name of the post-secondary institution with which your campus farm or garden is affiliated (please avoid using acronyms)?
7. What year was your campus farm or garden established?
8. Is your campus farm or garden open to the public?
9. What is the size of your campus farm or garden (in acres)?
10. Is your campus farm or garden certified organic? (*If YES, please indicate the number of acres that are certified organic in the field below.*)
  - a. YES \_\_\_\_\_
  - b. NO, but our campus farm or garden is in transition to becoming certified organic.
  - c. NO, our campus farm or garden is not certified organic.
11. What types of crops are/were grown at your campus farm or garden this season? (Please select all that apply.)
  - a. Field and forage crops (including grains)

- b. Field-grown vegetables
  - c. Greenhouse-grown vegetables
  - d. Tree fruits and nuts
  - e. Berries
  - f. Herbs (culinary and/or medicinal)
  - g. Flowers (edible, cut and/or potted)
  - h. Other, please specify \_\_\_\_\_
12. Does your campus farm or garden currently have livestock?
- a. **If yes**, specify what species/type(s) of livestock your campus farm or garden has, how many of each species/type and how long your campus farm or garden has had them? (*Part 2 – Category CF1*)
    - i. Does your campus farm or garden sell animal-based foods (i.e. chicken eggs, beef, etc.) produced by these livestock species/type(s)? If yes, please indicate the types of animal-based foods.
  - b. **If no**, did your campus farm or garden have livestock in the past?
    - i. **If yes**, what species/type(s) of livestock did your campus farm or garden have, how many of each species/type, how long did your campus farm or garden have each species/type, and how long ago was this?
      - 1. Did your campus farm or garden sell animal-based foods (i.e. chicken eggs, beef, etc.) produced by these livestock species/type(s)? If yes, please indicate the types of animal-based foods.
      - 2. Does your campus farm or garden want to have livestock in the future?
        - a. If yes, why? (*Part 2 – Category CF2*)
        - b. If no, why not? (*Part 2 – Category CF3*)
    - ii. **If no**, does your campus farm or garden want to have livestock in the future?
      - 1. If yes, why? (*Part 2 – Category CF4*)
      - 2. If no, why not? (*Part 2 – Category CF5*)
13. Would you or another representative from your campus farm or garden be willing to participate in Part 2 of this study, which would involve a 30 to 45-minute follow-up interview with Natalie Yuen (the Co-Investigator of this study) via Skype? *Please note that the participant in Part 2 of this study should be the campus farm or garden's director, manager or designate who holds a position of authority or leadership.*
- a. **If yes**, please indicate your name and contact information of the person who will be interviewed in the field below.
14. Please review a preliminary list of campus farms and gardens at post-secondary institutions in Canada and the United States (linked below). Are there other campus farms and/or gardens at post-secondary institutions in Canada and/or the United States that you are aware of that are NOT on this list?



**LIST OF CAMPUS FARMS AND GARDENS AT POST-SECONDARY  
INSTITUTIONS IN CANADA AND THE UNITED STATES**

- a. **If YES**, please provide the name(s) of the campus farm(s) and/or garden(s) in the field below, and if possible, please also provide the name and contact information of a representative from the campus farm(s) and/or garden(s), preferably its **director, manager or designate who holds a position of authority or leadership.**

## **PART 2: INTERVIEWS:**

### **PROJECT: The Successes, Challenges and Barriers of Integrating Livestock on Campus Farms and Gardens at Post-Secondary Institutions in Canada and the United States**

**Time of Interview:**

**Date:**

**Place/Method:**

**Name of Participant or Representative:**

**Position of Participant of Representative:**

This in-depth, semi-structured interview is the second part (Part 2) of a study on the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States. (Note: the term *Integration* simply refers to having livestock on your campus farm or garden.)

You have been asked to participate in this study because you are a director, manager and/or designate who holds a position of authority or leadership at a campus farm or garden at a post-secondary institution in Canada or in the United States that is either:

- Currently integrating livestock. (*Category CF1*)
- Not currently integrating livestock, but integrated livestock in the past and wants to integrate livestock in the future. (*Category CF2*)
- Not currently integrating livestock, but integrated livestock in the past and DOES NOT want to integrate livestock in the future. (*Category CF3*)
- Not currently integrating livestock, has never integrated livestock and wants to integrate livestock in the future. (*Category CF4*)
- Not currently integrating livestock, has never integrated livestock and DOES NOT want to integrate livestock in the future. (*Category CF5*)

You were sent these interview questions in advance to prepare for our discussion, but as a brief overview, I will begin by asking you a series of questions in order to characterize and become more familiar with your campus farm or garden. Then I will follow with a series of questions related specifically to the integration of livestock on your campus farm or garden. This interview will be recorded and later transcribed (though I will be taking notes during our discussion), and the information gathered from your responses will be analyzed and discussed to determine the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States. The interview will take approximately 30 to 45 minutes to complete.

In addition to providing insight into the successes, challenges and barriers of integrating livestock on campus farms and gardens, this study will also contribute to the growing body of literature and research on campus farms and gardens through the publication of my thesis in UBC's digital repository for teaching and research materials ([cIRcle](#)) and may be published in a peer-reviewed agricultural journal in the near future.

As an added incentive for participating in this interview, your campus farm or garden will be entered into a draw to receive a set of books related to agriculture and/or livestock welfare, care and handling in agricultural systems. The draw will occur once the interviews are complete.

The risks of participating in this study are minimal as the information that is being gathered relates to a subject matter that is not of a personal nature. The minimal risks to you may include social risks if, for example, your responses reflect negatively on the post-secondary institution with which your campus farm or garden is affiliated. However, you have the option to provide as much or as little detail as possible in your responses and to refrain from answering questions that you feel may pose some form of social risk to yourself and/or to your campus farm or garden.

Any identifying information that will be published/made available from this interview is limited to your name, contact information and your position title/role at your campus farm or garden.

All information collected from this interview will be stored on an encrypted USB drive and on UBC Workspace 2.0 (UBC's on-campus cloud based sharing service that complies with Canadian, Provincial and UBC security requirements).

If you have any questions or concerns throughout the course of this interview, you may interrupt me at any time. If you have any questions or concerns after the interview is complete, please feel free to contact myself or Dr. Arthur Bomke, the Principal Investigator (our contact information was included in my initial contact email/letter).

**Having heard/read all of this information, do you verbally consent to participate in this interview?**

**YES      or      NO**

Do you have any questions before we proceed?

**Interview Preparations:** (*For all campus farms and gardens.*)

Can you tell me what you did to prepare for this interview? For example: did you consult with another person associated with your campus farm or garden for information? Did you have to do some historical research about your campus farm or garden?

**Systems Analysis:** (*For all campus farms and gardens.*)

I would like to start by characterizing your campus farm or garden as a system.

**1. Goals:**

- a. What is the mission, vision and/or mandate of your campus farm or garden?
- b. What is the mission, vision and/or mandate of the post-secondary institution with which you are affiliated?
- c. (*Ask only if applicable to the campus farm or garden.*) Are there any specific goals that your campus farm or garden has with respect to integrating livestock - i.e. roles you would like livestock to play in your farm or garden system, such as being a part of a crop rotation, or engaging the local and academic communities?

**2. Boundaries:**

a. **Physical boundaries:**

- i. What is the size/total area of your campus farm or garden? (*Confirm answer from survey.*)
  1. How much of that is in crop production?
  2. For campus farms and gardens that are categorized as “CF1”, how much of the total area is allocated to livestock?
  3. For campus farms and gardens that are categorized as “CF2” & “CF3”, how much of the total area was allocated to livestock?

b. **Perceptual boundaries:**

- i. *Perceptual boundaries* can be anything that imposes limitations, regulations or restrictions on activity at your campus farm or garden – i.e. financial boundaries, restrictions enforced by regulatory bodies at your post-secondary institution (animal care committees, etc.), labour shortages, philosophical/ethical perspectives or concerns about raising livestock, etc. With this definition in mind, please list and explain the perceptual boundaries of your campus farm or garden.

**3. Components:**

- a. What are the main components of your campus farm or garden system?
  - i. **Biological and physical components:**
    1. **Physical farm or garden site:**
      - a. Soil type?

- b. Climate/duration of growing season?
- c. Types of infrastructure (i.e. processing facility for crops or animal-based food products, housing for livestock, etc.)?

2. **Crops:**

- a. Type(s) of crops grown? (*Confirm answers from survey.*)

3. **Animals:**

- a. For campus farms and gardens categorized as “CF1”, what types of livestock? How many of each type? (*Confirm answers from survey.*)
- b. Wildlife and predators?

ii. **Socio-economic components:**

1. **Finances:**

- a. Does your campus farm or garden generate revenue?
  - i. If **YES**, how? (For example: selling crops or animal-based food products through markets, on-campus sales, wholesale, CSA; other program offerings such as workshops, farmer training programs, summer camps for children, etc.)?
  - ii. If **NO**, how does your campus farm or garden operate from a financial perspective?
- b. Does your campus farm or garden receive other sources of funding (e.g. funding from the post-secondary institution, donations, research grants, subsidies, etc.)?
  - i. If **YES**, please explain.
- c. Does your campus farm or garden have paid employees?
  - i. If **YES**, what types of employees and how many:
    - 1. Faculty?
    - 2. Permanent staff?
    - 3. Students?
- d. Does your campus farm or garden have unpaid labour (e.g. volunteers, interns, etc.)?
  - i. If **YES**, what types of unpaid labour and how many:
    - 1. Volunteers?
    - 2. Unpaid interns?
    - 3. Other?

2. **Student engagement:**

- a. What types of student engagement opportunities are available on your campus farm or garden?
  - i. Experiential learning opportunities for students?

- ii. Course offerings and activities?
- iii. Research or student-driven projects?
- iv. Volunteer or service-based learning?

3. **Community engagement:**

- a. What types of community engagement opportunities are available on your campus farm or garden?
  - i. Experiential learning opportunities for community members?
  - ii. Community-based learning opportunities?
  - iii. Volunteer opportunities?

4. **Interactions:**

- a. What are some of the key interactions between the **boundaries (physical and perceptual) and the components (biological and physical, and socio-economic)** that would help to describe or characterize your campus farm or garden?
  - i. *An example of a **physical boundary-component interaction** would be the area of your campus farm or garden (physical boundary) limiting the types/numbers of livestock that are/have been integrated (biological and physical component) or limiting the amounts/quantities of crops grown (biological and physical component).*
  - ii. *An example of a **perceptual boundary-component interaction** would be your post-secondary institution's regulations regarding the use of animals in research (perceptual boundary) that impact the livestock on your campus farm or garden (biological and physical component).*
- b. What are some of the key interactions between the **components** that would help to describe or characterize your campus farm or garden?
  - i. *An example of a **component-component interaction** would be the revenue from crops that are grown and sold (biological and physical component) help to pay wages for the campus farm or garden's employees (socio-economic component).*

This is the end of the systems analysis portion of the interview. We will now proceed to the questions related to the integration of livestock on your campus farm or garden.

*For Category CF1: Campus farms and gardens that are currently integrating livestock*

1. I would like to know more about the decision-making and thought process behind integrating livestock on your campus farm or garden.
  - a. Why did you/your campus farm or garden decide to integrate livestock?
  - b. Who led this initiative/decision? (e.g. Student? Faculty/department? Staff?)
  - c. What type(s) of livestock were integrated? How many of each type?
  - d. What was the rationale for the type(s) and number of livestock chosen?
  - e. Please walk me through the process of integrating livestock on your campus farm or garden. (*Note: For campus farms and gardens with multiple livestock species, please describe the process for each species separately **IF** the process was different.*)
    - i. Did you have to seek permission from the post-secondary institution?
    - ii. Were there any regulations that were imposed by the post-secondary institution or as a result of the way your campus farm or garden operates that you needed to consider (e.g. an Animal Research/Welfare regulatory body, organic certification standards, etc.)?
    - iii. How was this initiative funded?
    - iv. What kinds of management decisions (i.e. animal husbandry decisions, crop system decisions, labour decisions, etc.) did you have to make with respect to integrating livestock?
      1. *For example: provision of shelter, food resources, water, protection from predators, labour requirements, the role(s) the livestock would play as a part of your campus farm or garden system, etc.*
  - f. Were the type(s) and numbers of livestock that you originally integrated different from the type(s) and numbers of livestock that you currently have? (*Confirm answers from survey.*)
    - i. If so, why?
  - g. How are the livestock currently involved in your campus farm or garden system?  
OR What role(s) do they play in your campus farm or garden system?
    - i. *For example: how are they involved or linked with crop production on your campus farm or garden? Is their manure composted and used in the fields? Are the livestock involved in a crop rotation?*
  - h. Has the livestock's involvement/role in your campus farm or garden system changed since they were first integrated?
    - i. If so, what was their involvement or role originally?
    - ii. Why didn't it work out as you originally planned?

2. Challenges of Integrating Livestock:
  - a. What were the challenges you/your campus farm or garden experienced/faced in integrating livestock into your campus farm or garden system?
  - b. Do these challenges still exist?
    - i. If **YES**, please explain why.
    - ii. If **NO**, please explain how you overcame these challenges.
  - c. What are some of the other challenges you are currently facing with respect to caring for and managing the livestock on your campus farm or garden?
3. Successes of Integrating Livestock:
  - a. Earlier in this interview we discussed the mission/vision/mandate of your campus farm or garden and of the institution you are affiliated with (*revisit responses re: "Goals" in systems analysis provided by participant*). Is the integration of livestock into your campus farm or garden system in line with these visions/missions/mandates?
    - i. If **YES**, please explain why.
    - ii. If **NO**, please explain why not.
  - b. Does the integration of livestock meet the other goals of your campus farm or garden (*if applicable, revisit responses re: "Goals" in systems analysis provided by participant*)?
    - i. If **YES**, please explain why.
    - ii. If **NO**, please explain why not.
4. Has the integration of livestock benefited your campus farm or garden?
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.
5. Has the integration of livestock provided students, community members, volunteers, your campus farm or garden staff, etc. with any unique learning and/or engagement opportunities?
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.
6. Overall, do you feel that the integration of livestock on your campus farm or garden was/is a worthwhile venture?
  - a. If **YES**, please explain why.
  - b. If **NO**, please explain why not.



***For Category CF2: Campus farms and gardens that are not currently integrating livestock, have integrated livestock in the past and want to integrate livestock in the future***

1. I would like to know more about the history/background of integrating livestock on your campus farm or garden:
  - a. Were you involved in the integration of livestock on your campus farm or garden?
  - b. When did your campus farm or garden have livestock? (*Confirm answer from survey.*)
  - c. What type(s) of livestock? How many of each type? (*Confirm answer from survey.*)
  - d. How were the livestock involved in your campus farm or garden system or what role did they play in your campus farm or garden system?
  - e. What are the reasons why your campus farm or garden does not have livestock at this time? (*Confirm answer from survey.*)
2. Challenges of Integrating Livestock:
  - a. What were some of the challenges that you/your campus farm or garden experienced/faced in integrating livestock into your campus farm or garden system?
3. Successes of Integrating Livestock:
  - a. Earlier in this interview we discussed the mission/vision/mandate of your campus farm or garden and of the institution you are affiliated with (*revisit responses re: "Goals" in systems analysis provided by participant*). Was the integration of livestock into your campus farm or garden system in line with these visions/missions/mandates?
    - i. If **YES**, please explain why.
    - ii. If **NO**, please explain why not.
  - b. Did the integration of livestock meet the other goals of your campus farm or garden (*revisit responses re: "Goals" in systems analysis provided by participant*)?
    - i. If **YES**, please explain why.
    - ii. If **NO**, please explain why not.
4. Why do you want to integrate livestock on your campus farm or garden again?
5. What type(s) and numbers of livestock would you like to integrate on your campus farm or garden?
6. What role(s) do you envision they would play in your campus farm or garden system? Please explain.

7. Did/Will the integration of livestock benefit your campus farm or garden?
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.
  
8. Did/Will the integration of livestock provide students, community members, volunteers, your campus farm or garden staff, etc. with any unique learning and/or engagement opportunities?
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.
  
9. Barriers of Integrating Livestock:
  - a. What are the barriers that are preventing you from integrating livestock on your campus farm or garden (i.e. having the necessary animal husbandry expertise, veterinary oversight, manure handling, year-round access to expertise for longer-lived species, barriers IACUCs (animal care and use committees) might raise before approving the integration of livestock on your campus farm or garden, etc.)?
  
  - b. What does your campus farm or garden require in order to remove/alleviate these barriers?

***For Category CF3: Campus farms and gardens that are not currently integrating livestock, have integrated livestock in the past and DO NOT want to integrate livestock in the future***

1. I would like to know more about the history/background of integrating livestock on your student farm or garden:
  - a. Were you involved in the integration of livestock on your campus farm or garden?
  - b. When did your campus farm or garden have livestock? (*Confirm answer from survey.*)
  - c. What type(s) of livestock? How many of each type? (*Confirm answer from survey.*)
  - d. How were the livestock involved in your campus farm or garden system or what role did they play in your campus farm or garden system?
  - e. What are the reasons why your campus farm or garden does not have livestock at this time? (*Confirm answer from survey.*)
2. Challenges of Integrating Livestock:
  - a. What were some of the challenges that you/your campus farm or garden experienced/faced in integrating livestock into your campus farm or garden system?
3. Successes of Integrating Livestock:
  - a. Earlier in this interview we discussed the mission/vision/mandate of your campus farm or garden and of the institution you are affiliated with (*revisit responses re: "Goals" in systems analysis provided by participant*). Was the integration of livestock into your campus farm or garden system in line with these visions/missions/mandates?
    - i. If **YES**, please explain why.
    - ii. If **NO**, please explain why not.
  - b. Did the integration of livestock meet the other goals of your campus farm or garden (*revisit responses re: "Goals" in systems analysis provided by participant*)?
    - i. If **YES**, please explain why.
    - ii. If **NO**, please explain why not.
4. Did the integration of livestock benefit your campus farm or garden? (*Note: If the participant was not involved in the integration of livestock, they may not be able to answer this question.*)
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.

5. Did the integration of livestock provide students, community members, volunteers, your campus farm or garden staff, etc. with any unique learning and/or engagement opportunities? *(Note: If the participant was not involved in the integration of livestock, they may not be able to answer this question.)*
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.
  
6. Can you elaborate on why your campus farm or garden does not want to integrate livestock in the future? Please provide specific reasons. *(Confirm answer from survey.)*

***For Category CF4: Campus farms and gardens that are not currently integrating livestock, have never integrated livestock and want to integrate livestock in the future***

1. Why do you want to integrate livestock on your campus farm or garden?
2. What type(s) of livestock would you like to integrate on your campus farm or garden?  
How many of each type?
3. What role(s) do you envision they would play in your campus farm or garden system?  
Please explain.
4. Will the integration of livestock benefit your campus farm or garden?
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.
5. Will the integration of livestock provide students, community members, volunteers, your campus farm or garden staff, etc. with any unique learning and/or engagement opportunities?
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.
6. Barriers of Integrating Livestock:
  - a. What are the barriers that are preventing you from integrating livestock on your campus farm or garden (i.e. having the necessary animal husbandry expertise, veterinary oversight, manure handling, year-round access to expertise for longer-lived species, barriers IACUCs (animal care and use committees) might raise before approving the integration of livestock on your campus farm or garden, etc.)?
  - b. What does your campus farm or garden require in order to remove/alleviate these barriers?

***For Category CF5: Campus farms and gardens that are not currently integrating livestock, have never integrated livestock and DO NOT want to integrate livestock in the future***

1. Please elaborate on the reasons why your campus farm or garden has never integrated livestock and does not want to do so in the future. (*Confirm answers from survey.*)
2. Would you consider any of these reasons to be barriers that are preventing you from integrating livestock on your campus farm or garden?
  - a. If **YES**, please explain which reasons are barriers and why.
  - b. If **NO**, please explain why not.
3. **If you answered YES to Question 2**, what does your campus farm or garden require in order to remove/alleviate these barriers?
4. In general, do you think that integrating livestock on campus farms and gardens is/can be beneficial?
  - a. If **YES**, please explain why and in what ways.
  - b. If **NO**, please explain why not.

## APPENDIX C: PHASE II – LETTER OF INITIAL CONTACT

November 1<sup>st</sup>, 2016

To Campus Farm and Garden Directors, Managers and/or Designates:

My name is Natalie Yuen and I am a graduate student in the Integrated Studies in Land and Food Systems Program in the Faculty of Land and Food Systems at the University of British Columbia (UBC). I am writing to ask for your help with an important study.

In 2011, I spearheaded a project at the [Centre for Sustainable Food Systems at UBC Farm](#) to integrate livestock (specifically cattle and chickens) into the UBC Farm's annual crop rotation. Through this project, I experienced a number of successes, challenges and potential barriers in integrating livestock into the UBC Farm system (both from an institutional perspective and an agroecological perspective) and I wanted to know how my experience compared with others at campus farms and gardens at post-secondary institutions in Canada and the United States. Therefore, *your participation in this study is needed*. (Please note that your campus farm or garden **DOES NOT** need to have livestock in order for you to participate.)

### **STUDY INFORMATION:**

**Principal Investigator: Dr. Arthur A. Bomke, Associate Professor Emeritus, Applied Biology, Faculty of Land and Food Systems, UBC**

**Co-Investigator: Natalie Yuen, M.Sc. Candidate, Integrated Studies in Land and Food Systems, Faculty of Land and Food Systems, UBC**

The purpose of this study is to determine the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States. This study is divided into two parts.

- **Part 1: An online survey of campus farms and gardens at post-secondary institutions in Canada and the United States.**  
*(Estimated participation time required: 5-10 minutes.)*
- **Part 2: Interviews (via Skype) regarding the successes, challenges and barriers of integrating livestock on campus farms and gardens at post-secondary institutions in Canada and the United States.**  
*(Estimated participation time required: 30-45 minutes.)*

## **PARTICIPATION BENEFITS AND INCENTIVES:**

The benefits of this study include the **creation of a directory of campus farms and gardens at post-secondary institutions in Canada and the United States**. This directory will serve to consolidate and provide updated information about campus farms and gardens in order to assist in the **foundation of a campus farm and garden network in Canada and the United States**. This study will also provide insights into the successes, challenges and barriers of integrating livestock on campus farms and gardens, and will contribute to the growing body of literature and research on campus farms and gardens through the publication of this Master's thesis in UBC's digital repository for teaching and research materials ([cIRcle](#)) and possibly in a peer-reviewed agricultural journal in the near future. The results of this study will be publicly accessible through UBC cIRcle after September 2017. In addition, requests for the results of this study can be made by emailing me (Natalie Yuen) directly.

As an incentive, **participants in this study will be entered into a draw to receive a set of (new) books related to agriculture and/or livestock welfare, care and handling in agricultural systems**. One set of books will be offered for participants in Part 1 of this study, and another set will be offered for participants in Part 2. The draws will occur once the interviews in Part 2 are complete.

## **PARTICIPATION RISKS:**

The risks of participating in this study are minimal as the information that is being gathered relates to a subject matter that is not of a personal nature. The potential minimal risks to participants include social risks if their responses reflect negatively on the post-secondary institution with which they are affiliated. However, participants will be given the option to provide as much or as little detail as possible in their responses and to refrain from answering questions that they feel may pose some form of social risk to either themselves or to the campus farm or garden they represent.

## **LIMITS TO CONFIDENTIALITY:**

Identifying information that will be published/made available from this study is limited to the names, contact information and position of the participants of the campus farms and gardens.

The UBC Survey Tool will host the survey in Part 1. Interviews in Part 2 will be held via Skype and will be audio recorded for transcription, coding and data analysis.

All information collected from this study will be stored on an encrypted USB drive and on UBC Workspace 2.0 (UBC's on-campus cloud based sharing service that complies with Canadian, Provincial and UBC security requirements).



## **HOW TO PARTICIPATE:**

Participation in this study is completely optional. If you would like to participate, please click the link below and you will be directed to the online survey (Part 1). One of the questions in the survey will ask if you (or another representative from your campus farm or garden) wish to be interviewed regarding the successes, challenges and barriers of integrating livestock on your campus farm or garden (Part 2). If you (or your campus farm or garden representative) agree to participate in Part 2, I will contact you to set up a date and time for an interview via Skype.

### **[Part 1: Online Survey of Campus Farms and Gardens](#)**

This survey will remain open until **FRIDAY, NOVEMBER 18<sup>th</sup>, 2016 at 11:59pm.**

## **QUESTIONS:**

If you have any questions about this study, please feel free to email me or the Principal Investigator, Dr. Arthur Bomke. Our contact information can be found on page 1 of this letter. Thank you for taking the time to read this information, and I hope that I can count on your participation in this study.

Sincerely,

**Natalie Yuen, M.Sc. Candidate**

Integrated Studies in Land and Food Systems

Faculty of Land and Food Systems at the University of British Columbia

*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 xxx@xxx.xxx.xx or call toll free x-xxx-xxx-xxxx.*