FARMING OURSELVES TO DEATH?
THE CONFLUENCE OF CRISES IN THE FOOD SYSTEM IN BRITISH COLUMBIA AND CANADA, AND THE POTENTIAL FOR CHANGE

by

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B.A.(Hon.), The University of Victoria, 2003

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS IN PLANNING

in

The Faculty of Graduate Studies

THE UNIVERSITY OF BRITISH COLUMBIA
(Vancouver)

February 2011

Abstract

Throughout the late 20th century North American agriculture has followed a trajectory of increasingly industrialized production and processing of food (Donaldson and Macinerney 1973; Qualman and Tait 2004). Ownership of Canada's agriculture land and resources is increasingly consolidated (Qualman and Tait 2004; Statistics Canada 2006a). This raises important questions about how well this consolidated ownership, a decreasing number of corporations focused on agri-business, can serve the public (Qualman and Tait 2004; Berry 1995; Shand 2002; Shiva 2002) and the negative environmental impacts of industrial agriculture (Goering *et al.* 1993; Roach 2005). An increasingly energy-dependent food system is also a major concern in an era of climate change and peak oil (IPCC 2007; Walker and Sidneysmith 2007; Duncan and Youngquist 1999; Pimentel *et al.* 1973; Hirsch 2005). With British Columbia's small farmers facing a range of ecological, economic and socio-political challenges, (Govender *et al.* 2006; Connell *et al.* 2007; Cowichan Green Community 2008; Masselink, 2008; SmartGrowth 2008) planners in BC need to consider food security and its relationship to local and global crisis as a key issue of 21st-century planning.

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Acknowledgments

I would like to thank my supervising committee for their time and effort on making this thesis possible. Doctor Bill Rees, whose critical insights and system-wide thinking helped make this thesis what it is. Dr. Herb Barbolet, whose incredible knowledge of local and global food systems were invaluable at all stages of writing and editing. Dr. Maged Senbel, who in my defense helped me to see some further implications of this work.

I would also like to thank my partner, Bronwen Payerle, for alternately encouraging me and nagging me, while I worked full time, to complete this thesis. I would never have got it done without you. I would also like to thank my father-in-law, George Payerle, for taking so much time editing, revising and discussing early drafts. You provided much needed direction, encouragement and critique. Of course, thank you to my family for their support and kindness throughout. And finally, to my peers and friends: Tamsin Mills and Erica Crawford Boettcher, friends and compatriots throughout SCARP class. Rob Rao, Emerson Belland, Mike Anderson, Adam Ford and Andrew Bennett for the thoughtful conversations over our many years of friendship and many beers. Thank you.

1. Introduction

1.1 Background: Food and the Erosion of Civilizations

> Historians blame many culprits for the demise of once flourishing cultures: disease, deforestation, and climate change to name a few. While each of these factors played varying—and sometimes dominant—roles in different cases, historians and archaeologists rightly tend to dismiss single-bullet theories for the collapse of civilizations. Today's explanations invoke the interplay among economic, environmental, and cultural forces specific to particular regions and points in history. But any society's relationship to its land—how people treat the dirt beneath their feet—is fundamental, literally. Time and again, social and political conflicts undermined societies once there were more people to feed than the land could support. The history of dirt suggests that how people treat their soil can impose a life span on civilizations. (Montgomery 2007)

David Montgomery's 2007 work, *Dirt: The Erosion of Civilizations*, documents instances of cultural collapse at least in part related to the erosion of soils necessary for food production. Other works examine the forces behind the failure of complex civilizations, such as Jared Diamond's *Collapse: How Societies Choose to Fail or Succeed* (2005) and Joseph Tainter's *The Collapse of Complex Societies* (1990). However, the uniqueness of Montgomery's work is his focus on the soil beneath our feet. Montgomery effectively argues that growing populations led many civilizations to increase their burden on the soil, eroding over generations a resource necessary for the production of food. In many cases, he explains, this erosion of soil led to the rise of empires dependent on colonial lands to produce the food needed by capital cities, a pattern we see continue today. Often, the imperative of producing this food led to the application of the very same detrimental agricultural techniques abroad that had eroded soils at home (Montgomery 2007)

In the case of Rome, Montgomery explains, the erosion of soil led to the consolidation of small farms into large estates that implemented intensive agricultural techniques. Large-

scale farms tended away from practices that ensured long-term fertility, such as letting fields lay fallow or inputting manure, and emphasized for-profit production. Despite knowledge of soil conservation techniques, the demand for intensive and constant cultivation to feed Rome and a farming labour force composed of peasantry with little or no incentive to ensure the long-term fertility of the fields, contributed to the widespread degradation of Rome's, and Italy's, soils. A serious loss of soil quality in turn led to a higher dependence on imported foods as Romans were increasingly unable to feed themselves on the marginalized lands around the capital. Montgomery argues that, over time and in conjunction with a number of other political and economic factors, the loss of soil ultimately contributed to the downfall of the Roman Empire (Montgomery 2007).

1.2 Problem Statement

Throughout the late 20th century American and Canadian agriculture have followed a trajectory of increasingly industrialized production and processing of food (Donaldson and Macinerney 1973; Qualman and Tait 2004). This pattern is similar in important ways to the patterns of land management Montgomery describes in ancient Rome. Ownership of Canada's agriculture land and resources is increasingly consolidated (Qualman and Tait 2004; Statistics Canada 2006a). This raises important questions about how well this consolidated ownership, a decreasing number of corporations focused on agri-business, can serve the public (Qualman and Tait 2004; Berry 1995; Shand 2002; Shiva 2002). Pimentel *et al.* (1973) show that large-scale industrial agriculture is incredibly energy dependent. Evidence of negative impacts on ecosystems and biodiversity as a result of industrial practices, practiced by large- and small-scale producers alike has been well documented (Goering *et al.* 1993; Roach 2005). Moreover, Montgomery (2007) points out that our dependence on artificial fertilizers has had a significant impact on soil fertility across North America, as traditional methods of soil conservation are ignored in favour of high-yield, intensive agriculture dependent.

These problems associated with consolidated, industrial agriculture may well be compounded by the emergence of global climate and energy crises. Climate change is likely to have a significant impact on food production both globally and here in BC (IPCC 2007; Walker and Sidneysmith 2007). Additionally, agricultural technologies and

transportation systems dependent on fossil fuels will be rendered vulnerable to rising fuel prices or scarcity brought about by peak oil (Duncan and Youngquist 1999; Pimentel *et al.* 1973; Hirsch 2005). BC's food production is currently insufficient to feed the population (BC Ministry of Agriculture and Lands 2007); the province is therefore vulnerable to food scarcity unless some planning is undertaken to address the impacts of these crises on the food system.

1.3 Purpose and Structure

While Roman agriculture may seem an unlikely departure point for a discussion of 21st-century food systems, it nonetheless provides important historical lessons for addressing serious sustainability and social justice concerns currently facing our food system. The Canadian and Roman agricultural stories are not identical. However, just as many prominent Romans warned of agricultural collapse (Montgomery 2007), so now are many critics concerned about the direction in which the modern industrial food system is heading. According to these critics, myriad social, ecological and economic problems arise from the way in which food is cultivated, processed and distributed in the 21st century (Berry 1995; Goering *et al.* 1993; Pimentel *et al.* 1973; Qualman and Tait 2004; Shand 2002; Shiva 2002; UCS 1992). Concerns range from control of seeds, plants and intellectual property (Shand 2002; Shiva 2002), to impacts of new agricultural technologies on ecological systems (Goering *et al.* 1993), to our dependence on what will arguably become a scarce resource this century, oil (Hirsch 2005; I-SIS 2005). The purpose of this thesis is therefore to assess these various critiques, understand whether and how significantly the concerns raised by critics will apply to BC's food system, and to explore briefly case studies that provide alternative models for food production and distribution. This work aims to accomplish this by addressing the following questions:

- What are the impacts of increased consolidation and industrialization in North American and Canadian agriculture?
- What types of impacts will climate change and peak oil have on food production globally and in BC?
- What types of social, economic and ecological challenges are small-scale BC producers currently facing?

- What are some examples of alternative models that can help provide policy solutions that will help BC transition toward a more sustainable, socially just food system?

This work is divided into four main chapters, and an introduction and conclusion. Chapters 2 and 3 provide an overview of the critiques of our food system in two broad areas: the industrialization and consolidation of agricultural production and the links between global energy and climate crises and food production. Chapter 2 examines the current state of food production, characterized by increasingly consolidated ownership of land and resources and increasingly industrial methods of production. Chapter 3 explores the link between global ecological concerns and agriculture, particularly agriculture's impact on climate change and the impact of peak oil on food production. Chapter 4 examines agricultural challenges in BC, drawing any pertinent links between the issues at play here and the various socio-economic and ecological issues explored in the first two chapters. Finally, Chapter 5 explores alternative models and suggests some policy directions to support sustainable agriculture. Insofar as many of the criticisms leveled at the food system found to be valid, it becomes important to consider what models can provide some lessons for transforming the food system in BC.

1.4 Assumptions and Lenses

This research explores the link between industrial food production, the impacts of crises in energy and climate and BC's food system. In so doing I have made certain assumptions, chosen certain definitions over others and used certain critical lenses. These should be made explicit. The first definition rest to a term used heavily throughout this work: the food system. Here food systems can be "understood as the ways that people produce, obtain, consume and dispose of their food" (Mendes 2006). A just and sustainable food system "is defined as one in which food production, processing, distribution and consumption are integrated to enhance the environmental, economic, social and nutritional health of a particular place" (City of Vancouver Food Policy Council 2009).

The second term used throughout is food security, which brings with it host of other terms that need unpacking. Food security can be defined as "a situation in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes self-reliance and social justice" (Hamm and Bellows, 2003). Hamm and Bellows address three key ideas in this definition: sustainability, self-reliance and social justice. Sustainability is defined by the United Nations Brundtland Report as meeting "the needs of the present without compromising the ability of future generations to meet their own needs." (WCED 1987). Given the considerable social, economic and ecological impacts that oil scarcity (Duncan and Youngquist 1999) and climate change (IPCC 2007) will have in the 21st century, the need for a more sustainable economy, and consequently food system, becomes self-evident.

The importance of self-reliance is underscored when considering food production and transportation in light of a peak oil scenario Increasingly, peak oil is recognized as a reality of 21st-century economics, though there is significant debate around when peak oil will actually occur (Duncan and Youngquist 1999; Hirsch 2005). However, as fossil fuels increase in cost, imported food dependent on fossil fuel imports will become more costly. Finally, as Wendy Mendes points out, "Over and above the role of nourishing populations, food and food systems have often come to symbolize a society's beliefs and struggles around ideals of social redistribution, justice, and democracy itself" (Mendes 2006). If we accept this statement, then any study of food security must necessarily address the inequitable distribution of food that currently exists (Goldberg and Green 2009)

This work is predicated on the belief that although the twin notions of sustainability and social justice can, and often do, conflict, they are not mutually exclusive. Indeed, much of the work provides evidence that they are, in fact, intrinsically linked and mutually dependent. In examining notions of sustainable and just food practices (particularly agricultural practices), I use a tripartite lens, involving ecological, social and economic critiques. While for the purposes of analysis it is useful to make these distinctions,

dividing a critique this way does not suggest that these components, of agriculture for example, are not linked. Indeed, these three elements of my critique, articulated by the Brundtland Report (1987) as the three-legged stool of sustainability, are very much a system of sustainability and social justice.

While a range of food system concerns, including processing, transportation and distribution, are present throughout the work, this is not an attempt at a full food system evaluation. This work is also largely a critique. While I examine some case studies that point toward solutions, I have focused the bulk of this work on articulating the problem in the hopes that even a focused critique will help lead to more effective solutions. I therefore focus primarily on the cornerstone of any food system: agriculture itself.

The scope of my analysis shifts throughout the course of this work. While my primary interest is British Columbian agriculture and food, BC is necessarily entrained in the Canadian and global food systems. My analysis therefore shifts, as necessary, between the provincial, national and international scopes. Additionally, in critiquing industrial agriculture, I necessarily reference American farming. This is because of the extent of industrial agriculture in our southern neighbour, and the consequent availability of information on American farming practices.

The problem is daunting. While there is increasing discussion in media over peak oil and climate change, thus far little meaningful action has been made. Although we are just beginning to see the effects, this work proposes that our food system is already in the midst of a crisis. Just as the ancient Romans expanded their empire without acknowledging the soil crisis occurring in their own fields, so we are intensifying our agricultural practices without recognizing how quickly we are drawing down the natural resources upon which we so heavily depend, by degrading our soils and polluting our waterways (Montgomery 2007; Goering *et al.* 1993). In great part this is the fault of our current economic system, which presupposes that monetary wealth and well-being are synonymous (Cobb *et al.* 1995). In other ways, however, our current situation speaks to a much deeper crisis of culture. Wendell Berry (2002) explains that

> One of the primary results—and one of the primary needs—of industrialism is the separation of people and places and products from their histories. To the extent that we participate in the industrial economy, we do not know the histories of our families or our habitats or our meals (Berry 2002)

Despite these challenges, there remain reasons for guarded optimism. Examples exist of just and sustainable food systems around the world, from Russia to Brazil. Understanding our predicament and learning from some successes, may yet yield a just and sustainable food system here in BC.

2. Corporate Globalization, Industrial Agriculture and Food Democracy's Crisis

Canada's national history, from European colonization to confederation to our current era, reveals a nation founded on agriculture. A cornerstone of our economy and the basis for industrial economic development, agriculture has played a key role in the shaping of the Canadian nation (Rasmussen 1995). While primary agriculture's contribution to the Gross Domestic Product is small, at 3.4% in 2007 (Statistics Canada 2007a), agriculture and agri-food represent a more substantial contribution to Canada's economy, with 8.0% of the 2005 Canadian GDP and 12.8% of 2005 employment (Agriculture and Agri-Food Canada 2008a).

Two trends have dominated Canadian agriculture since World War II: ownership of agricultural land and resources has been increasingly consolidated and farmers have become increasingly reliant on a range of industrial agricultural technologies (Statistics Canada 2006a; Qualman and Tait 2004). These technologies provide real and perceived benefits for agricultural producers, including the opportunity to reduce labour and increase short-term yields (Goering *et al.* 1993). However, the competitive advantages supposedly conferred by new agricultural technologies have been found to hold few tangible economic benefits for farmers themselves. Furthermore, benefits of agricultural technology have been called into question by a range of social and ecological issues currently associated with their use (Qualman and Tait 2004; Berry 1995; Goering *et al.* 1993). Fortunately, while Canadian agriculture is still in the process of shifting toward large-scale, industrial operations (Statistics Canada 2006a), there are still a number of small and medium-scale, often family, farms, particularly in British Columbia (Statistics Canada 2003).

One important reason for the continued viability of independent Canadian farmers is the prominence of marketing boards in Canada, particularly the Canada Wheat Board. These boards allow independent agricultural producers the collective resources to compete with large-scale agricultural business in the global marketplace (CWB 2010a). However,

marketing boards are currently threatened by federal agricultural policies that favour American-style consolidation of agricultural production, an effort to align Canadian and American agricultural and trade policies (WTO 2008; CWB 2010c). This move is significantly impacting the economic viability of independent agricultural producers in Canada (CWB 2010c).

In order to understand the long-term impacts of consolidated farm ownership and industrial agricultural practices that are increasingly evident in Canada, we therefore need to, at points, shift our attention south, to the United States. By observing the impacts of agricultural consolidation and industrialization in the US, we can better evaluate the current trajectory of Canadian agriculture.

2.1 Modern Canadian Agriculture

2.1.1 Agricultural Statistics Over Time

Though not a keystone of the early trapping and fishing economy, agricultural production was practiced in Canada at least as far back as 1541, by Jacques Cartier in Quebec (Rasmussen 1995). It has played a role in the colonial history of every province (Rasmussen 1995), and while agriculture's contribution to Canadian GDP has diminished, the agriculture and agri-food business nonetheless contributes significantly to the Canadian economy (Agriculture and Agri-Food Canada 2008a).

Canada had its highest number of farms in 1941, with 732,832 farms counted in the census that year. These farms represented over 70 million hectares of land, nearly 23 million of which was in crops. While farmland has stayed relatively consistent and land in crops has increased significantly since that time, the number of farms has steadily decreased, with 229,373 farms counted in the 2006 census. These farms accounted for over 67 million hectares of land, nearly 36 million of which was in crops. Thus, while the average farm size in 1941 was about 96 ha, this had increased substantially to an average of nearly 295 ha per farm in 2006 (Statistics Canada 2007c).

British Columbian agriculture followed a similar trend toward larger farm size, with an average farm size in 1941 of about 62 ha, and an average farm size in 2006 of about 143 ha. However, the number of farms in BC did not decrease as dramatically as in Canada as a whole, dropping from 26,394 farms in 1941 to 19,844 in 2006. Instead, much of this change in average farm size can be accounted for through the significant increase of farm and crop lands: while there were about 1.6 million ha of farmland in 1941, this increased to about 2.8 million ha of farmland in 2006. Similarly, while there were only 238,414 ha of cropland in 1941, by 2006 this had more than doubled to 586,238 ha (Statistics Canada 2007c). There is no indication of how the quality of land being farmed changed in this time period.

2.1.2 Competition and Consolidation: Agriculture in 21st-Century Canada

> As…farmers strive to compete in a global marketplace, they continually look for new efficiencies, whether in the form of economies of scale, new technology, or vertically-integrated operations. Since the end of the Second World War, agriculture has become increasingly industrialized. This has meant fewer but more efficient farms (Ontario Ministry of Agriculture and Food 2000)

Despite short-term commodity price fluctuations, long-term prices have declined significantly over time, with grain prices decreasing over 40% between 1984 and 2004 (Statistics Canada 2006a). As global commodity prices have dropped, Canadian agricultural producers' various approaches to production and marketing of agricultural products have allowed some Canadian farmers to remain economically competitive. In some cases marketing boards, such as the Canadian Wheat Board, have helped mitigate against declining commodity prices (Government of Saskatchewan, 1996) caused by increased global competition and the implementation of new agricultural technologies and practices (Qualman and Tait 2004). While marketing boards, such as the CWB, offer some protection, the number of grain producers in Canada is declining (Statistics Canada 2006b). The pressure producers therefore face to remain economically competitive is leading toward a form of Canadian agricultural in which a narrowly defined agricultural efficiency, focused on technology and farm consolidation, remains the sole option for many producers (Qualman and Tait 2004).

Efficiency, as it is used above, can be understood as the combined impact of reduced operating costs, increased agricultural yields and lower labour investments that lead to a maximization of profit (Qualman and Tait 2004): simply put, efficiency is earnings over cost.[1] In theory, new technologies and practices benefit both agricultural producers and consumers. A key assumption underlying the agricultural trends in Canada is "that open, deregulated, globalized markets will drive our farms to higher levels of efficiency, raising incomes for farmers and lowering prices for consumers. A key part of this plan to increase efficiency is to increase farm size" while producing cheaper agricultural goods for consumers (Qualman and Tait 2004). Increased mechanization, consolidated farm ownership and vertical integration of food production and processing represent the reality of agricultural production in 21st-century Canada (Qualman and Tait 2004; Statistics Canada 2006a).

One key economic model that Canadian producers use to mitigate against declining commodity prices is the marketing board. Marketing boards providing individual farmers the opportunity to pool resources and access global markets (Canadian Wheat Board 2010a). Perhaps the most significant marketing board in Canada is the Canadian Wheat Board, which operates through the Manitoba, Saskatchewan, Alberta and the Peace River region of BC. The CWB Act requires all non-feed wheat, durum wheat and barley producers in these areas to market their agricultural product through the CWB (Canada Wheat Board Act 2007). The CWB's is mission statement is:

> Creating a sustainable competitive advantage for farmers and customers through our unique business structure, innovative marketing, superior service, profitable investments and effective partnerships. (CWB 2010b)

The advantage of this system is that it gives individual farmers price stability, as the CWB sets the price that purchasers must pay for grain. This price stability, and the pooling of individual resources that provide collective access to global grain markets,

[1] This definition views efficiency narrowly, emphasizing financial capital, and externalizing the degradation or loss of natural capital. This will be further discussed in section 2.2.3.

have allowed Canadian grain producers to remain economically competitive, in spite of reduced commodity prices globally. In 1996, one study showed that farmers gained a $13.35 premium per tonne of wheat produced, totaling $265 million, "because of the market power brought to producers by single desk selling through the board" (Former Saskatchewan Agriculture and Food Minister Eric Upshall, quoted in Government of Saskatchewan 1996).

Despite the role of the CWB in allowing wheat and barley farmers to remain globally competitive, there is still evidence that grain farmers are facing significant economic pressures. Between 2001 and 2006, the number of oilseed and grain farmers fell from 69,671 to 61,667, about 11.5% (Statistics Canada 2006b). Due to the nature of Statistics Canada's use of industry groups this does not offer a precise picture of barley and wheat farmers; however, it does offer some indication that farmers producing grains are facing the types of pressures noted above.

In order to remain competitive, farmers have therefore increasingly adopted more mechanization and new crop and livestock management techniques to increase yields, even while ownership was consolidated into fewer, larger farms (Statistics Canada 2006). There is also a tendency toward greater vertical integration in Canadian agricultural businesses, where one firm controls several stages from the development of agricultural inputs to the processing of agricultural products (Qualman and Tait 2004; Statistics Canada 2006).

While Canadian marketing boards, particularly the CWB, have therefore allowed individual producers to compete in the global market, pressure to create more economically efficient farms has forced significant mechanization and consolidation of farms and vertical integration of other agri-businesses. Furthermore, as pressure to liberalize trade increases from the World Trade Organization (WTO 2008; CWB 2010c) and align Canadian agricultural policies with the United States (Qualman and Tait 2004; CWB 2010d) the advantages offered to producers by marketing boards in Canada may soon be eliminated (WTO 2008). These concerns will be discussed further in section 2.2.1.

2.1.3 A Rationale for Agricultural Technologies

There are five key forms of technology for agricultural production: mechanization, artificial fertilizers, pest control technologies, hybrid seeds and related biological technologies, and integrated and biological pest management techniques (Goering *et al.* 1993; Kogan 1998). Each of these technologies offer some benefit, at least in the short term, to agricultural producers (FAO, 1975; Goering *et al.* 1993; Kogan 1998; Pimentel *et al.* 1998).

Mechanization refers to agricultural technologies including mechanized land-clearing, tilling and harvesting technologies as well as irrigation and milling technologies. Agricultural mechanization has greatly reduced the amount of human labour required to clear, till and harvest agricultural products, even while increasing food yields (Goering *et al.* 1993; Pimentel *et al.* 1998). Artificial fertilizers are nutrient substitutes used to dramatically increase crop yields in the short-term (Goering *et al.* 1993).

Pest control technologies are pesticides used "to control crop loss from insects, animals and micro-organisms" (Goering *et al.* 1993).[2] Hybrid seeds and biological technologies are crop types bred or genetically modified to respond well to the use of artificial fertilizers and pesticides and in some cases to further boost yields (Goering *et al.* 1993). Integrated and biological pest management "is a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest population at levels below those causing economic injury" (FAO 1975). This combination of technologies encourages large, monoculture-oriented agricultural systems that, in theory, feed more people and prove more economically profitable (Goering *et al.* 1993).

[2] It should be noted that even as early as 1992 there was significant evidence that increased pesticide use did not necessarily result in decreased crop loss. According to one early study, despite "the tenfold increase in insecticide use in the United States from 1945 to 1989, total crop losses from insect damage nearly doubled from 7% to 13% (Pimentel *et al.* 1992)

2.2 A Critique of Modern Industrial Agriculture

2.2.1 The Economic Impacts of Developing Industrial Agriculture in Canada

Qualman and Tait (2004) critique Canada's shift toward consolidated, industrial agriculture, analyzing the increased costs and declining incomes of Canadian farmers. By critically assessing the assumptions behind economies of scale and agricultural technology they argue that consolidated industrial agriculture provides no benefits for small farmers, and instead profits major corporations that control other stages of the food system.[3]

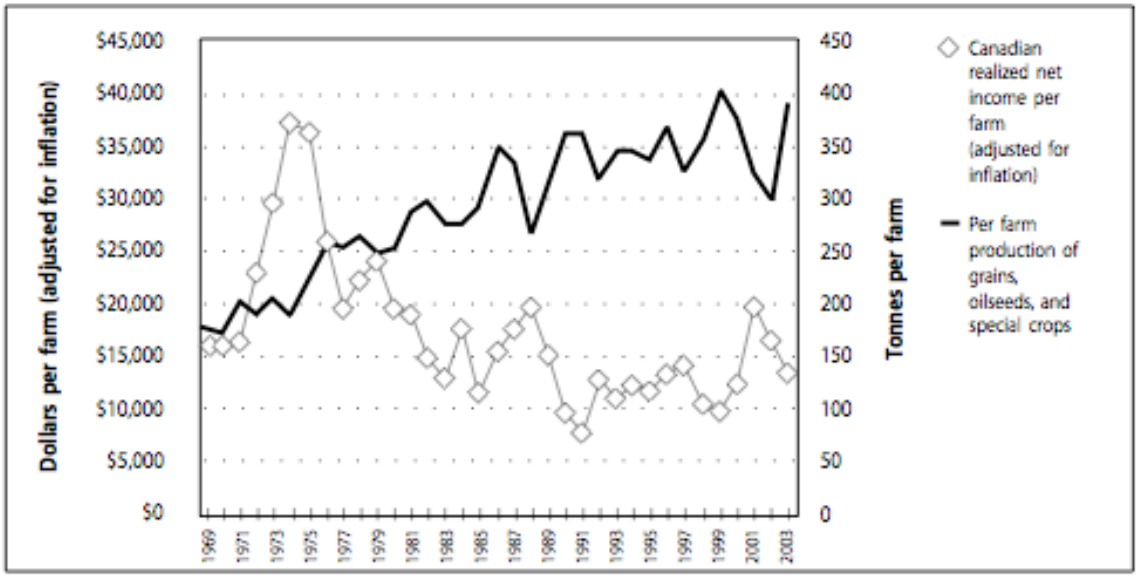
A key assumption Qualman and Tait explore involves the relationship between Canadian farmers' net income and crop yields. In theory, increased economic efficiency of farms should yield cheaper products, while also resulting in a higher net income for farmers. Since 1969, however, even while per-farm production of grains, oilseeds and special crops has increased, the net income of farmers has fallen dramatically (Qualman and Tait 2004). The use of marketing boards to set prices and protect farmers against declining commodity prices has met with some success (Government of Saskatchewan 1996) and provides producers with access to the market and market power, thereby increasing the financial stability of independent agricultural producers (Qualman and Tait 2004). Producers' net incomes are still declining, however, showing the impact of increased global competition on Canadian agriculture and, in part, due to efforts to eliminate single desk marketing boards (Qualman and Tait 2004; CWB 2010c). Furthermore, farmers who mortgage their farms to invest in new technologies, in order to remain competitive, are sometimes left unable to pay farm mortgages when commodity prices decline (Goering et al. 1993)

Farmers face increased cost burdens from several directions. Even while commodity prices decline, farmers face increasing pressure to invest in new technology.

[3] It should be noted that Qualman and Tait are both former members of the National Farmers' Union Executive Board. Their perspective therefore clearly favours independent Canadian agricultural producers. Rather than creating bias, this perspective allows an insightful critique of the supposed economic benefits of agricultural consolidation and vertical integration.

Furthermore, input suppliers are disproportionately benefiting from agricultural production. While "[f]armers increased their output and gross revenue . . . input and technology makers captured 144% of that additional revenue." (Qualman and Tait 2004). Farmers are therefore in a difficult position, between the companies that produce inputs and new technologies, (including fossil fuel producers, fertilizer, chemical, seed and machinery companies and banks), and the transportation, processing and retail companies. Qualman and Tait (2004) note that "Other than the farmer link, every link of the agri-food chain is dominated by between two and ten multi-billion-dollar transnationals and, perhaps not coincidentally, every one of these links is characterized by large profits."

Figure 1: Per Farm Grain Production and Net Income: 1969-2003



Source: Qualman and Tait, 2004.

While marketing boards offer Canadian producers some measure of protection against the overall decline global commodity prices, they nonetheless face significant threats. A recent rise in global agricultural commodity prices (FAO 2010) has changed the nature of Canadian agricultural commodity prices in the short term; however, there is no indication that this will have long-term impacts on small and medium-scale farm profitability (Statistics Canada 2009a). Despite declining incomes, provincial and federal government

moves to deregulate marketing boards (Qualman and Tait 2004) and align agricultural policy with the United States (CWB 2010d), and WTO (and the Conservative minority government) threaten the Canadian Wheat Board (WTO 2008; CWB 2010c).[4] Thus, while the unique use of marketing boards to provide stability and equitable access to processors for Canadian producers provides some measure of protection against declining global commodity prices, these marketing boards are under threat from domestic and international, ideologically-driven, free market policies.

Since 2000 the Food and Agriculture Organizations of the UN' food price index, and indication of the cost of food prices for consumers has risen dramatically from a twenty-year low of 89.5 to more than double that, 190.9, in 2008.[5] In 2007 and early 2008 global food shortages cause a sharp increase in price of wheat, soy, rice and corn (Lee *et al.*, 2010). Although food prices have eased since 2008, as of July 2010 the food price index remains high at 166.5 (FAO 2010).

Despite this global trend, Canadian farmers have not increased their profitability. In October 2009 farmers received 17.7% less for their crops than the year before. Overall this "marks the 11th consecutive year-over-year decrease for the crops index" (Statistics Canada 2009a). This indicates a significant schism between what farmers are getting paid for their crops and what consumers are paying for food.

Several important exceptions should be noted in Canada. Grains saw a significant price increase in the latter half of 2007 and throughout 2008 over the previous ten years' prices. By late 2009, however, grain prices had fallen significantly, and were comparable from to pre-2007 prices (Statistics Canada 2009b). Fruit was the only commodity to record increased prices between October 2008 and October 2009 (Statistics Canada

[4] There is an emphasis in this section on the Canada Wheat Board because of its size as a national marketing board. However, as Qualman and Tait point out, other marketing boards at the provincial level (for livestock and crops) result in the same economic protections for independent farmers, and can be detrimental for these producers when eliminated (Qualman and Tait 2004).

[5] The FAO's Food Price Index is an average of 6 food commodity group price indices, including meat, dairy, cereals, oils, fats and sugar: "in total, 55 commodity quotations considered by FAO specialists as representing the international prices of the food commodities are included in the overall index" (FAO 2010).

2009a). These market fluctuations may be an isolated event or they may occur more often due to other environmental and market conditions (to be discussed further in the next chapter). Regardless, in order to ensure the long-term profitability of small and medium-scale farmers in Canada, mechanisms and institutions that help farmers receive better prices for their goods are vital.

Despite this, provincial and federal governments have in recent years eliminated or threatened to eliminate single desk entities, through deregulation policies and new legislation (Qualman and Tait 2004). For example, until the late 1990s hog farmers in Saskatchewan and Manitoba sold their animals through provincial marketing boards. This gave producers "price transparency, equal access to the market, equal prices for products of equal value, and market power when dealing with packers" (Qualman and Tait 2004). Deregulation in both provinces led to the elimination of these marketing boards. Because a single buyer, Maple Leaf, owns 80% of processing capacity deregulation of the marketing boards significantly shifted the economic context for hog producers in these provinces, with prices now controlled largely by a single purchaser, instead of sellers (Qualman and Tait 2004). Given that only two transnationals slaughter and process most Canadian beef, three transnationals process most of our cereal and five transnationals sell the majority of our food (Qualman and Tait 2004), a move to eliminate marketing boards places control of the food system squarely in the hands of these corporations, rather than in the hands of producers and consumers.

While the CWB is still currently in operation, it nonetheless faces threats on a number of fronts: current Conservative federal efforts to deregulate the CWB (Harper Index 2007; CBC 2006a; CBC 2006b), pressure from American trade interests (CWB 2010d) and pressure from the World Trade Organization (WTO 2008; CWB 2010c). The federal Conservative minority government's pressure on the Canadian Wheat Board has significant since their election in 2006. In November of 2006 the Federal Agriculture Minister removed CWB president, Adrian Measner, for his pro-monopoly stance (CBC 2006b). Prior to Measner's termination, the Conservatives had removed three CWB directors, one of whom speculated that it was due to his pro-monopsony stance (CBC

2006a). Despite this, CWB members recently voted in four (of five) pro-monopoly directors, thus ensuring, for the time being, the continuation of the single-desk marketing board (NFU 2008). However, trade pressures from the United States and the WTO nonetheless continue to pressure the CWB. CWB cites a four-pronged approach, announced by the US Trade Representative in 2002, including:

1. To pursue a WTO dispute settlement case against the CWB. This case concluded in 2004, when the WTO unequivocally dismissed the U.S. allegations against the CWB as groundless.
2. To pursue countervailing duty and anti-dumping cases against Canadian wheat and durum. This occurred, resulting in the imposition of the prohibitive tariff on Canadian spring wheat. The durum tariff was revoked after a ruling that imports did not injure U.S. producers. The wheat tariff was lifted in February 2006 after the CWB won its appeal to a NAFTA panel.
3. To identify specific impediments to U.S. wheat entering Canada. This was addressed in the WTO dispute settlement case, which resulted in changes to Canadian government rules related to grain segregation and the rail revenue cap.
4. To "vigorously" pursue reform of monopoly State Trading Enterprises in the WTO agriculture negotiations. This is occurring at present. (Quoted from CWB 2010d)

The final point has been further pursued in recent WTO negotiations, with the Canadian Wheat Board marketing structure singled out “for elimination” in the December 6, 2008 round of negotiations (CWB 2010d). Despite the benefits offered to producers by marketing boards, these domestic and international moves to dismantle place Canadian farmers in a significantly more precarious situation than they would otherwise face, in light of global competition and long-term declining commodity prices.

With the decline of marketing boards, farmers increasingly compete with each other as well as foreign products, thus further driving down commodity prices, rather than cooperating to help set prices (Qualman and Tait 2004). As economies of scale dominate

any economic sector, they tend to result in increased oligopoly power, providing a counterpoint to the efficiency gains. Qualman and Tait (2004) point out "when increases in efficiency are smaller than those in oligopoly power, prices will rise regardless of efficiency effects." The authors therefore conclude that

> There is a good reason to suspect that as competition declines among the tiny number of transnationals that dominate each link in our agri-food chain, efficiency also declines. Alternatively, even if efficiency increases, the lack of competition will greatly reduce pressure on those corporations to pass along any benefits of efficiency to farmers, workers, or consumers (2004).

They therefore conclude that to increase economic benefits, policies promoting economies of scale need to be balanced with those that increase competition levels among the transnationals that make up every link in the agri-food chain except production, while simultaneously promoting cooperation among Canada's producers (Qualman and Tait 2004).

Finally, Qualman and Tait tackle the myth that technology increases yields. Qualman and Tait discuss the Glenlea Long-Term Crop Rotation Study, where test plots compared the cost and yields for four types of agriculture systems: conventional, low-input, pesticide-free and organic crop production systems. In this study, farmers using no crop inputs were found to have the highest net returns per acre, even without premium organic prices (Qualman and Tait 2004). While gross revenues are up, net revenues are significantly down, forcing many farmers in Canada, and BC, to take off-farm jobs (Qualman and Tait 2004; SmartGrowth BC 2008).

The Canadian government's push toward increased agricultural efficiency through economies of scale represents a concern for independent Canadian agricultural producers. Qualman and Tait point out that the shift toward consolidated, industrial agriculture in Canada is not achieving the goals intended. That is, it is not necessarily benefiting both consumers, with lower food prices, and producers, with greater profit as yields grow

thanks to technology. That the reality differs so significantly from the promise of industrial, technology-driven agriculture, and that we pursue this agricultural trajectory despite the problems associated with industrial agriculture, speaks to a powerful agribusiness lobby in Canada and an ideologically-driven, set of free market trade policies that benefit transnational corporations, though rarely independent agricultural producers (Qualman and Tait 2004; CWB 2010c; CWB 2010d). Moreover, trends in Canadian agriculture reflect a much deeper global trend toward corporate control of a range of resources (Council of Canadians 2007; Shiva 2002).

2.2.2 Socio-cultural Impacts of Corporate, Industrial Agriculture

The US has made a significant shift toward large-scale agriculture, as evidenced through increased mechanization of agriculture, and the decline of agricultural communities (Donaldson and MacInerney 1973). Donaldson and MacInerney's work, alongside others critical of large-scale industrial agriculture, reveals the negative social impacts of the shift toward large-scale farming, particularly with regard to employment, community well-being and health. Furthermore, increasingly consolidated ownership of farms result in increased oligopoly power, as discussed above. This consolidation of power damages community in the erosion of 'food democracy,' a concept based largely on the notion that individuals and communities should have some measure of control over their food system and that it should provide them with nutritious, affordable food (BC Food System Network 2010).

Employment and Agricultural Communities

Shifts in agricultural technology have the potential to greatly affect the nature of farming and rural communities in developed countries, as evidenced by what happened in the US (Donaldson and McInerney 1973). From the 1940s onward, farms in the U.S. have become increasingly consolidated and mechanized, decreasing the demand for labour in primary agricultural activities. Moreover, many small farms, facing significant economic challenges in remaining competitive, have been forced to shut down. Much of the agricultural labour force has become increasingly involved in secondary agricultural activities, such as transportation and processing, or has migrated to urban centres. In the

U.S., the introduction of mechanized agricultural processes was therefore directly responsible for a significant shift in the rural social fabric of the United States (Donaldson and McInerney 1973).

The displacement of workers, however, is not simply an employment concern; the rise of industrial, corporate agriculture has had significant negative impacts on communities. Wendell Berry explains that "farmers have not benefited—not, at least, as a class—for as a result of this agenda they have become one of the smallest minorities. Many farmers, sad to say, have subscribed to this agenda and its economic assumptions, believing that they would not be its victims. But millions, in fact, have been its victims—not farmers alone, but also their supporters and dependents in our rural communities" (Berry 1995). This assertion arises from the fact that "Mechanisation encourages farming on a large scale. Small farmers are generally unable to use technologies to full advantage and are compelled to either expand their operations or leave agriculture altogether" (Goering *et al.* 1993). Expansion incurs debt to finance the significant investments required for large-scale agriculture. With a general fall in prices due to increased agricultural production, trends toward industrialization have left "millions of small farmers unable to meet mortgage payments" and more have gone into bankruptcy (Goering *et al.* 1993).

Public Health

Industrial agriculture also significantly increases risks to the health of farmers, factory workers and consumers. Pesticides have numerous negative, long-term effects, including carcinogenicity (tendency to increase rates of cancer), mutagenicity (tendency to increase rates of mutation of an organism) and teratogenicity, (tendency to cause birth defects). Academic studies on farm and factory workers exposed to pesticides are compelling, and too numerous to examine in detail here (Goering *et al.* 1993). Furthermore, the International Labour Organization (ILO) estimated that of the 330 000 fatal workplace accidents in 1997, 170 000 were among agricultural workers. Indeed,

> The increasing use of machinery and of pesticides and other agrochemicals has aggravated the risks. In several countries, the fatal accident rate in agriculture is

> double the average for all other industries. Machinery such as tractors and harvesters cause the highest frequency and fatality rates of injury. Exposure to pesticides and other agrochemicals constitute major occupational hazards which may result in poisoning and death and, in certain cases, work-related cancer and reproductive impairments (ILO 2000).

Thus, from the perspective of safety and well-being for farm workers, it can be seen that industrial agricultural technologies represent a significant hazard.

Furthermore, from a public health and safety perspective, pesticides represent a significant potential threat to the general populace. "Scientists are finding higher and higher levels of pesticides in people throughout the world" and while the effects are still not fully understood, given the carcinogenic, mutagenic and teratogenic tendencies of many of these chemicals, the shift toward their use in our food system presents a long-term health concern (Goering *et al.* 1993). Finally, nitrates leached from chemical fertilizers are increasingly being found in groundwater supplies in globally. These have been linked to higher rates of cancer, birth defects and the nitrate-induced illness methemoglobinemia, which deprives the brain of oxygen (Goering *et al.* 1993). Agricultural technologies, then, have increased yields in the short-term, but their public health effects over the long-term may in fact be disastrous.

Intellectual Property

Another disturbing element of corporate, industrial food production is the control of intellectual property in the form of seeds. Control of biotechnology through patented genomes serves to undermine small-scale farmers' capacity to grow food profitably. By eliminating "the right of farmers to save and exchange seed, and to breed their own crops" biotechnology companies are creating monopoly controls over crops and livestock (Shand 2002). Not only does this place farmers at the behest of biotechnology firms, but the agreements they are forced to sign perpetuate the most ecologically damaging practices of industrial agriculture. The trend toward hybrid seeds and genetically

modified crops is undermining democratic control of food systems and consolidating control of agricultural production in the hands of a few large corporations (Berry 1995).

The Illusion of Choice

The form of agriculture currently on the rise in Canada therefore arguably represents a threat not simply to individual farmers, but to anyone who eats. While it should be noted that variety of products available to the average North American consumer has grown considerably with the rise of industrial agriculture, as the food system becomes vertically integrated, the ability to choose sustainably and equitably produced, healthy food is on the decline (Goering *et al.* 1993; Shiva 2002). Any examination of industrial agriculture must thus consider the larger system of which it is a part. Vandana Shiva likens industrial agricultural practices to a narrowing of the cultural mind, a

> faulty consciousness . . . entranced by the idea that the world is or should be uniform and one dimensional, that diversity is either disease or deficiency, and that monocultures are "efficient" and necessary for economic and social well-being (Shiva 2002).

Unless significant changes are made in ownership and practices within the food system, impending resource and ecological crises could well mean unforeseen hardship for many Canadians.

2.2.3 Ecological Impacts of Corporate, Industrial Agriculture

The ecological impacts of agricultural production are far-reaching. These impacts arise not simply from the direct negative impacts of new agricultural technology, but also from industry practices necessary to make use of new technologies. For example, the rise of monocultural practices associated with the tractor (or for that matter the plow) has had a host of effects on soil (Montgomery 2007). The efficiency gains made by many agricultural technologies externalize their ecological impacts. This section therefore

provides a brief overview of some of the key ecological problems present in our current industrial agriculture system that are often neglected in economic calculations.[6]

Fossil Fuels

Perhaps the most publicized ecological concern to which agriculture contributes is the issue of climate change. The shift toward increased mechanization, and the dependence of other agricultural technologies, particularly nitrogen fertilizers, on petroleum products, means that corporate, industrial agriculture is intimately linked to oil. While this link will be more fully explored in a later chapter, it is worth introducing it with a few important facts. As noted earlier, the advent of various agricultural technologies dramatically raised energy inputs per hectare of food production. Indeed, this shift was so dramatic that in 1983 the energy input in the form of nitrogen fertilizer exceeded "all energy inputs to the same hectare of maize in 1945" (Goering *et al.* 1993). In terms of both availability of petroleum products, and the impacts of fossil fuels on global climate, corporate, industrial agriculture today represents a significantly less sustainable option than even the form of agriculture practiced just after WWII.

Soil

Industrial agricultural technologies are currently contributing to a massive topsoil crisis. In 1992, the Union of Concerned Scientists issued a warning regarding, amongst other things, topsoil loss.

> Loss of soil productivity, which is causing extensive land abandonment, is a widespread by-product of current practices in agriculture and animal husbandry. Since 1945, 11 percent of the earth's vegetated surface has been degraded—an area larger than India and China combined—and per capita food production in many parts of the world is decreasing. (UCS 1992)

[6] It is all but impossible to identify and quantify the non-market costs that these technologies have in terms of their impact on social and natural capital. The notion of efficiency in agriculture therefore becomes significantly problematic.

This loss of topsoil is due, at least in part, to industrial technologies such as fertilizers and mechanization. The switch from mixed-cropping agriculture based on rotations to intensive, specialized, continuous cropping "is one of the prime reasons for increased erosion." Additionally, chemical inputs lead to "a reduction in organic matter in the soil and a deterioration in soil structure, a critical factor in erosion rates" (UCS 1992). At the same time as the UCS released their warning, it was estimated that 24 billion tonnes of topsoil were lost annually (Goering *et al.* 1993). Despite an understanding of the problem, by 2002 these rates had not changed (Community of NGOs 2002). The loss of topsoil represents a loss of soil biodiversity, impacts surrounding aquatic ecosystems, and makes farmland significantly less productive (Goering *et al.* 1993).

Water

Again the UCS sums up the situation well, if dismally:

> Heedless exploitation of depletable ground water supplies endangers food production and other essential human systems. Heavy demands on the world's surface waters have resulted in serious shortages in some 80 countries, containing 40 percent of the world's population. Pollution of rivers, lakes, and ground water further limits the supply

While not all of this is due to industrial agriculture, much of it is. Both surface and ground water are currently being exploited significantly for agriculture. In the United States, the Ogallala aquifer has been significantly reduced due to agriculture in California (Goering *et al.* 1993; Brown 2005). Over the long term this means reduced harvests, which threatens food security; some countries, including Saudi Arabia and China, have already experienced peak grain production, which is now declining due to reduced access to water (Brown 2005). Furthermore, soil erosion is directly contributing to the degradation of aquatic ecosystems: as soil runs off, it leads to eutrophication and the destruction of aquatic ecosystems (Goering *et al.* 1993). A prime example of this is the aquatic "dead zone" in the Gulf of Mexico of oxygen-depleted water—currently blamed on runoff of farm chemicals from the Mississippi basin (Roach 2005).

Loss of Crop Variety and Genetic Diversity

A final major ecological concern regarding corporate, industrial monoculture is the loss of crop varieties. The devastation to genetic diversity in the last century has been enormous: approximately 97% of vegetables—or 75 species—available in 1900 are now extinct. On top of this, the availability of many varieties has been significantly reduced: where 7000 varieties of apples and 2,400 cultivars of pears were once found in North America, typically only a few find of the currently find their way to the average consumer. Only six cultivars of corn are grown on 71% of corn land in the United States, while "two types of peas occupy 96% of the national acreage" there (Kimbrell 2005). Some varieties of fruits and vegetables are adapted to poor soils, or are pest resistant, and can therefore provide food sources that reduce the need for fertilizers and pesticides (Robertson and Swinton 2005). However, without access to this genetic diversity, farmers may have to rely more heavily on fossil fuel-based agricultural inputs.

2.3 Consolidation and Decline in Modern Agriculture

> Some historians see the growing indebtedness of Roman farmers as contributing to the empire's turmoil. . . .Contrary to the conventional wisdom that civil strife and wars had depopulated the Roman countryside, the disappearance of small farms occurred during a period of unprecedented peace. . . . Eventually the problem [of rural depopulation] became so acute that even free tenant farmers were decreed tied to the soil they plowed—and thus to the land's owners. The social arrangement between farmer-serfs and landowning nobles established by these laws survived long after the empire crumbled (Montgomery 2007).

After looking at Canadian and American trends, this ancient story sounds familiar. Destructive farming practices leading to soil erosion are rarely countered at the broader level by more sustainable soil husbandry practices, even when these practices of soil husbandry are well understood. Instead, they often instead lead to greater ownership of agricultural land by fewer individuals. This consolidation itself contributes to more destructive practices, as greater yields are sought from increasingly damaged lands by labourers and machinery with little or no interest in maintaining soil quality through

sustainable practices. From ancient Mesopotamia to 21st-century North America the same economics of greed and expansion among large-scale landowners have led civilizations to empire, colonialism and extinction (Montgomery, 2007).

The amalgamation of small farms, the drastic drop in rural populations and the use of intensive cultivation techniques seen in ancient Rome may well be considered the template for the recent trajectory of agriculture in Canada. While Canada, and in particular BC, has yet to reach the extent to which large-scale agriculture is practiced in the US, we are well on our way (Qualman and Tait 2004). Yet the market logic that drives the shift away from small-scale agriculture is deeply flawed. Even the economic arguments behind a shift toward industrial agriculture are problematic, as greater productivity and profit for independent producers are not actually achieved by consolidation and industrialization of agricultural practices. Although the social and ecological impacts of corporate, industrial agriculture are devastating, we persist in these destructive practices. This drive toward unsustainable, inequitable agricultural practices is dictated not by a need to provide sustainably and equitably produced, nutritious food, but by the drive for profit on the part of a few oligopolistic corporations. (Goering *et al.* 1993; Qualman and Tait 2004).[7] Our provincial and federal governments seems intent on furthering this agenda by undercutting institutions, such as the Canadian Wheat Board, that protect the profitability of small farmers.

The central question remains how does what's happening in the US, Canada and globally mean for the future of agriculture in BC? The geographic diversity of this province will likely lead to various outcomes, according to the circumstances in which producers find themselves. Areas such as the Lower Mainland and Peace River could well see a significant increase in consolidated, industrial farms. Arguably this is already occurring: 72% of BC's 135,826 hogs, for example, are produced by only 16 farms in the province, with each farm containing a minimum of 2653 animals. Compared to 1976, when there

[7] It should be acknowledged that some of the sources in this section, particularly references to the impacts of agricultural technology and studies of the social impacts of industrial farming are not recent. This simply reflects the fact that we have been implementing ecologically and socially detrimental agricultural practices for decades and highlights even more the need to develop more sustainable practices to ensure our food security.

were no hog farms with more than 2653, and production was more evenly distributed between small, medium and large-scale farmers, and it becomes clear that BC is not immune from the farm consolidation trend (Statistics Canada 2007d). However, in some cases consolidation of farms in BC will likely prove difficult or impossible. BC's mountainous geography could well resist the kind of consolidation seen in the American plain states. BC producers will nevertheless have to compete with cheaper commodities produced by industrial farms, across North America and globally.

Finally, a significant unknown is the future of global commodity prices. Little analysis is currently available on the impact of the 2007-08 global food crisis on Canadian farmers. If global commodity prices continue to decline (a likelihood in the near future, unless global trade is significantly disrupted), farmers in BC will be forced out of business, to raise their prices (pricing many in BC out of buying local) or find non-food agricultural uses for their land (e.g. wine). Should international trade be disrupted and commodity prices increase, small and medium-scale Canadian farmers may benefit, if they are able to avoid consolidation into large-scale farms. Low-income Canadians, however, will likely not.

3. Making the Global Local: Exploring the impacts of Global Overshoot, Peak Energy and Food Insecurity on British Columbia

Not only are industrialization and corporatization of the food system problematic, climate change and peak oil also threaten significantly to impact food security in the 21st century (IPCC 2007; Duncan and Youngquist 1999). The effects of these factors will be felt by every sector of the economy, particularly the agricultural sector (Duncan and Youngquist 1999). The links between climate and agricultural production are obvious; however, modern agriculture's dependence on energy is less visible, though equally important. In order to understand the nature of these threats and their relation to our food security, I examine the links between global overshoot, climate change, peak oil, and the food system. This reveals that the industrial agriculture discussed in chapter two, heavily reliant on fossil fuel-based inputs, will be increasingly vulnerable as resource scarcity and climate change manifest themselves more concretely.

3.1 Expansionist Economics, Over-Consumption and the Emerging Crises

At the beginning of the 21st century humanity faces crises on several fronts. In the coming century ecosystem collapse, climate change and biodiversity loss will alter the biosphere significantly, while the end of cheap energy will impact our interaction with it (Duncan and Youngquist 1999; Hirsch 2005; IPCC 2007a; UCS 1992; WWF 2008). While climate change will disproportionately impact developing countries, vulnerable populations even in high-income areas could be at risk (IPCC 2008b). The impacts of peak oil on day to day activities may also be profound: Hirsch (2005) notes that peak oil "will result in dramatically higher oil prices, which will cause protracted economic hardship in the United States and the world." Many critics point to humanity's over-consumption of natural resources as a root cause for these various crises (UCS 1992; Rees 1995; Wackernagel and Rees 1996; WWF 2008).[8] Before discussing the impacts of ecosystem crisis and peak energy on the food system, it is therefore important to

[8] While there may be no academic or professional consensus on the impacts of peak oil, consideration of worst-case scenarios would nonetheless be prudent in 21st-century food planning.

understand the ways in which over-consumption of resources (and attendant production of waste) has contributed to our ecological and energy crises.

3.1.1 Growing Beyond our Means: Overshoot, Climate Change and Inequity

Some critics of climate science attempt to keep debate alive regarding the validity of current climate science (Singer 2000). Others accept the seriousness of humanity's contribution to climate change, but propose solutions aimed at reducing greenhouse gas emissions while not significantly altering our economic trajectory (Jaccard 2007). The overwhelming sentiment of the most recent report from the United Nations International Panel on Climate Change, however, is that the climate is changing much more quickly than expected (IPCC 2007a). This reveals the importance of acting decisively to mitigate GHG emissions. Furthermore, we need to examine whether actions taken within a paradigm of continued economic growth, with the consequent increases in resource use, will adequately address issues of climate change.

As Rees (1999) states, "There is a growing consensus, including some mainstream institutions, that the current global economic development path is itself inherently unsustainable." This school of thought argues that humanity is in a state of global overshoot: that is, humanity's resource consumption is exceeding "the productive capacity of certain critical biophysical systems on every continent" (Rees 1999). With regard to climate change, this contention is supported by the IPCC's most recent report (2008b) that notes "Most of the observed increase in global average temperature since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations."

While the IPCC (2007a; 2008b) makes the link between climate change and human greenhouse gas emissions clear, other scientific tools are available that demonstrate the extent to which humanity's consumption of resources is adversely impacting our biosphere (WWF 2000; WWF 2008). One of these is ecological footprint analysis. The ecological footprint is defined as "an accounting tool that enables us to estimate the resource consumption and waste assimilation requirements of a defined human

population or economy in terms of a corresponding productive land area" (Wackernagel and Rees, 1996). It allows us to evaluate a number of human impacts on the biosphere, including distribution of resource consumption by population or region (Wackernagel and Rees 1996; WWF 2000; WWF 2008).

It is increasingly clear that our current consumption levels are well beyond the world's biocapacity to replenish itself or absorb our waste. The World Wildlife Fund's *Living Planet Report 2008* explains that "If we continue with business as usual, by the early 2030s we will need two planets to keep up with humanity's demand for goods and services." The WWF identifies a number of key areas currently being impacted by this overshoot, including water, soil, biodiversity and climate. Thus, while policy makers are currently (and rightly) paying much attention to climate change, it is important to situate our understanding of climate change within a broader ecological awareness. Our current economic growth patterns are in themselves placing an unsustainable toll on the earth's ecological systems.[9] Moreover, this over-consumption is due to a disproportionately small section of the global population (Rees 1999; WWF 2008).

International rankings of ecological footprint analysis by nation were featured in the World Wildlife Fund's *Living Planet Report* series and demonstrate the significant disparity in resource consumption between high-income and low-income nations. As Rees (1999) notes, the "five-fold increase in global income since World War II has been very unevenly distributed." The WWF reports reflect Rees' findings: national wealth corresponds highly to resource consumption as measured by ecological footprint. While in 2000 OECD countries averaged nearly 8 global average hectares/person, non-OECD countries represent significantly less resource consumption, averaging an ecological footprint of about 2 ha/person. The lowest ranking countries, such as Bangladesh, Afghanistan and Eritrea, all face serious, systemic concerns around poverty (WWF 2000). A more recent release of this report reveals that little has changed in the last eight years: nations such as the United States, the United Arab Emirates and Canada continue

[9] Our state of global overshoot means that we draw down and will eventually deplete natural capital, suchas soil, water and fossil fuels.

to rank highest in terms of per capita ecological footprint, while poorer nations make do with less (WWF 2008). This trend of inequitable resource consumption is also observable at a national level. A recent Canadian Centre for Policy Alternatives report notes that while Canada'sa's ecological footprint is 7.6 ha per capita,

> [t]he richest 10% of Canadian households are leaving behind an ecological footprint of 12.4 hectares per capita. To put that finding in context, their per capita ecological footprint is 66% higher than the national average. . . . The bottom 60% of Canadian households are leaving behind an ecological footprint that is below this national average (Mackenzie *et al.* 2008).

On both a national and international scale, then, resources are being consumed disproportionately by the wealthy: as Rees (1999) explains, "While twenty percent of the world's population enjoy an unprecedented level of material well-being, another twenty percent remain in abject poverty."

These analyses of global overshoot highlight two major concerns regarding our current economic model. The first is that humanity is currently consuming significantly more resources than the earth can replenish. The second is that, both internationally and within Canada, the wealthiest members of our society consume inequitably and unsustainably more resources than the lowest-income members of our society. When developing policies to address climate change it is therefore important to situate our understanding of the problem in relation to these concerns: to address the underlying over-consumption of resources, and the inequities associated with who consumes the bulk of our planet's resources, that are at the root of our climate change challenge. It also vital to understand and plan for the impacts climate change will have on food production, and develop agricultural approaches and systems that work to maintain (and if possible restore) natural capital, rather than contributing further to global overshoot by depleting natural capital such as soil and water.

3.1.2 The Quiet Crisis: Peak Oil and Its Consequences

Another consideration with regard to over-consumption of global resources is the likelihood of energy scarcity and higher energy costs. While crises such as water shortages, loss of topsoil, and degradation of our natural ecosystems represent major ecological changes that threaten humanity's food security, energy scarcity (in particular oil and gas scarcity) could also have significant consequences for global food production (Duncan and Youngquist 1999; Hirsch 2005). Evidence is mounting that, if it has not already, oil production will peak within the next 20 years at most (Duncan and Youngquist 1999; Hirsch 2005). Although the consequences will take time to become apparent, once oil production has peaked, the current economic system will become increasingly untenable (Duncan and Youngquist 1999).

As Duncan and Youngquist explain, every facet of industrial living is currently dependent on cheap and available oil; an international peaking of oil production will therefore have profound impacts on all of humanity. Duncan and Youngquist (1999) state in no uncertain terms the importance of oil:

> [i]n all human history, no substance has so changed economies, social structures, and lifestyles so rapidly, so profoundly, and affected so many people as has oil. Oil brought personal motor transport, intercontinental air travel creating worldwide economic and cultural interchanges, revolutionized agriculture and manufacturing, and lifted much work from the backs of many people.

While it is important to recognize the problems associated with oil, especially climate change, this statement reflects the deep dependence our society has on this form of energy.

The global peaking of oil production therefore represents a key point at which alternatives to our current fossil-fuel-dependent society must be implemented (Duncan and Youngquist 1999; Hirsch 2005). Duncan and Youngquist estimated in the year 1999 that world oil production would peak in 2007. At the time, they recognized that

predicting peak oil poses a number of difficulties, and that "the exact date will not be known for certain until some time after that year arrives, when it can be viewed in retrospect with the downward trend well established" (Duncan and Youngquist, 1999). However, they explain that their concern is not with absolute accuracy; they seek, rather, to 'encircle' a peak oil date that provides reasonable accuracy and allows us to plan for alternative forms of energy.

Figure 2: Peak Oil Forecasts

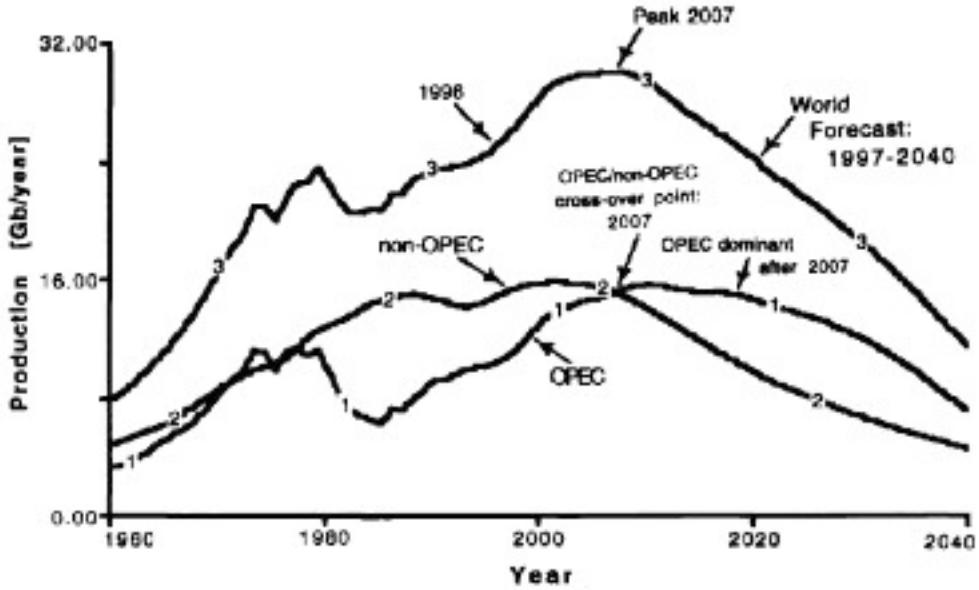


Figure 1. World, OPEC, and non-OPEC Oil production life cycles. Years 1960–2040 curves and peaks of the world (curve 3, peak 2007), non-OPEC (curve 2, peak 2001), and OPEC (curve 3, peak 2010). Cross-over point when OPEC production exceeds non-OPEC production (year 2007). In 2007, almost all OPEC production will be in the Persian Gulf region. OPEC nations outside the Gulf will have minor production, except for Venezuela. Some countries may have dropped out of OPEC because domestic demand exceeded production, with no surplus to export.

Source: Duncan and Youngquist, 1999.

Hirsch's more moderate work (2005) provides a range of estimates, ranging from the most pessimistic of 2006-07 (by AMS Bakhitari, an Iranian oil executive) to 2025 or later (Shell Oil's projection). Hirsch also cites M.C. Lynch, an energy economist, who believes there is no visible peak.[10] However, each of the oil companies, academic

[10] Lynch essentially argues that declining discoveries are not due to declining reserves. He argues that they are, in fact, heavily linked to government restrictions around exploration and drilling. He also critiques the use of the bell graph (figure 3.1), arguing that it doesn't indicate falling supplies, but rather a decline in marginal profits that we should expect from 'maturing' economies (Lynch 2003). However, as the costs of

geologists and others cited in this report all predict that peak oil will occur, with debate around when this will happen (Hirsch 2005).

While an exact date is not necessary to plan for peak oil, establishing a reasonably accurate date is a major concern. As Hirsch (2005) points out, the consequences of policy development that targets too early or too late a date would be grave. Nonetheless, failure to plan for peak oil would impact global society in the many way discussed by Duncan and Youngquist ten years ago.

3.2 Climate and Energy Crises: The Impacts of Global Crises on British Columbia's Food Productivity

While the consequences of climate change and peak oil will affect a range of economic, social and cultural endeavours, humanity's ability to feed a growing global population will become a major concern (IPCC 2007a; I-SIS 2005). In British Columbia, the impacts of climate change on agriculture will likely be mixed, benefiting some regions while adversely affecting others (Walker and Sydneysmith 2007). The consequences of peak oil for agriculture are considerably clearer: Canada and BC's heavy reliance on fossil fuels in agriculture (I-SIS 2005; Natural Resources Canada 2007) means that as oil becomes more expensive, agriculture will necessarily feel the burden of increased cost (Duncan and Youngquist 1999; Hirsch 2005).[11] Producing adequate food for a growing population in the face of these crises will therefore likely become a major provincial, national and global concern.

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exploration and development rise, the return in investment will at some point drop enough so as to make further exploration financially non-viable.

[11] It should also be noted that the United States Energy Information Administration's projections for energy predict an increase of 49% in the world energy market between 2007 and 2035. This includes a growth of 45% in liquid fuels by the year 2035, although they will account for a slightly smaller share of international energy consumption. This is expected to occur through improved production and unconventional sources (US EIA, 2010). However, this project relies on improvements and discoveries that have yet to occur. In essence, it assumes that extraction technologies will improve, unconventional sources will become economically viable and new discoveries will occur simply because the international market will have need for that much energy. This economically optimistic projection for access to energy therefore essentially assumes unlimited potential for energy growth, regardless of the ecological limitations of a finite resource.

3.2.1 Climate and Agriculture: An Uncertain Future

The current climate crisis will have enormous impacts on food security at a global level, disproportionately affecting the Global South (IPCC 2007a). Research from Natural Resources Canada suggests that agriculture in Canada and British Columbia will be at least somewhat protected against the impacts that climate change will likely have on many nations in the Global South (Lemmen and Warren 2004; IPCC 2007a; Walker and Sydnesmith 2007).

Despite these advantages, British Columbia and Canada remain linked to a global food system. British Columbia produces only an estimated 48% of its own food needs, relying on imports from other provinces and countries to make up the rest (BC MAL 2007). On the other hand, Canada remains, in fiscal terms, a net exporter of food, with "the value of our agricultural imports [at] three-quarters of [the value of] our agricultural exports" (Ngo and Dorff 2008). However, the balance of this in actual food tonnes is highly variable by food category. While Canada remains a net importer of fresh fruits and vegetables, particularly bananas, oranges and apples, some meat sectors, such as fish and beef, are significant exports.

Table 1: Exports and Imports of Selected Agricultural Goods in Canada, 2005, in Tonnes

Agricultural Product	Exports (thousands of tonnes)	Imports (thousands of tonnes)	Net (thousands of tonnes)
Apples, fresh	54.2	159.2	-105.0
Bananas, fresh	0.01[12]	449.7	-449.69
Cucumbers, fresh	50.0	42.4	7.6
Mushrooms, fresh	25.8	3.4	22.4
Pears, fresh	0.1	72.1	-72.0
Peppers, fresh	57.1	102.6	-45.5
Oranges, fresh	0.0	330.1	-330.1

[12] This figure may include import and re-exporting, not actual production (Ngo and Dorff 2008).

Agricultural Product	Exports (thousands of tonnes)	Imports (thousands of tonnes)	Net (thousands of tonnes)
Strawberries, fresh	0.2	74.8	-74.6
Tomatoes, fresh	146.3	171.7	-25.4
Potatoes, white fresh	0.4	0.2	0.2
Beef	580.5	126.4	447.6
Chicken	91.9	132.9	-41
Fish fresh and frozen sea fish	204.3	99.9	104.4
Mutton and lamb	0.3	19.3	-134
Pork	1,103.0	134.3	968.7
Turkey	24.5	14.9	9.6

Source: Adapted from Ngo and Dorff, 2008, Statistics Canada, *A Fork in the Road*, Catalogue no. 96-325-X

Food security in Canada and British Columbia is therefore intimately linked to agricultural productivity in the regions from which we import food, as well as those to which we export it. This means one of two things could happen as agricultural commodity prices rise globally. Should food prices rise in regions supplying our food before BC markets are affected, there could be significant pressure to increase agricultural production in BC (BC MAL 2007). However, should food costs rise more rapidly in BC than elsewhere, British Columbia could become more reliant on imports to supply the bulk of our food needs. In this context, it becomes necessary to understand the global implications of climate change for agriculture in order to properly understand food security concerns for Canada and BC in the 21st century.

Climate Change and Global Agricultural Conditions

The Intergovernmental Panel on Climate Change (IPCC) report, *Climate Change 2007: Synthesis Report* casts significant doubt on the possibility of benefits from climate shifts for vulnerable populations in the Global South. The IPCC predicts that in the short-term (next 2-3 decades), climate change could increase crop production by 5 to 20% globally.

However, they also point out that this will be accompanied by "important variability among regions" (IPCC 2007a). Some crops "near the warm end of their suitable range" will become too stressed in certain regions, while water scarcity will significantly affect current semi-arid areas. The IPCC predicts with

> high confidence that many semi-arid areas … will suffer a decrease in water resources due to climate change. Drought-affected areas are projected to increase in extent with the potential for adverse impacts on multiple sectors (IPCC 2007a)

including agriculture. Though not restricted to the Global South, likely the impacts will be most significantly felt there. The IPCC points out that many African nations, already food insecure, will face increased pressures due to global warming:

> By 2020, in some countries, yields from rain-fed agriculture could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised. This would further adversely affect food security and exacerbate malnutrition (IPCC 2007a).

Thus, while gains may be made in agricultural yields globally, these will come with a heavy cost to those nations and populations already stressed. The table below highlights some key effects of climate change on agriculture, but does not take into account any changes or developments in adaptive capacity (IPCC 2007a).

Table 2: Examples of possible impacts of climate change due to changes in extreme weather and climate events, based on projections to the mid- to late-21st Century.

These do not take into account any changes or developments in adaptive capacity. The likelihood estimates in column two relate to the phenomena listed in column one.

Phenomenon[a] and direction of trend	Likelihood of future trends based on projections for 21st century using SRES scenarios	Examples of major projected impacts by sector			
		Agriculture, forestry and ecosystems *{WGII 4.4, 5.4}*	Water resources *{WGII 3.4}*	Human health *{WGII 8.2, 8.4}*	Industry, settlement and society *{WGII 7.4}*
Over most land areas, warmer and fewer cold days and nights, warmer and more frequent hot days and nights	*Virtually certain*[b]	Increased yields in colder environments; decreased yields in warmer environments; increased insect outbreaks	Effects on water resources relying on snowmelt; effects on some water supplies	Reduced human mortality from decreased cold exposure	Reduced energy demand for heating; increased demand for cooling; declining air quality in cities; reduced disruption to transport due to snow, ice; effects on winter tourism
Warm spells/heat waves. Frequency increases over most land areas	*Very likely*	Reduced yields in warmer regions due to heat stress; increased danger of wildfire	Increased water demand; water quality problems, e.g. algal blooms	Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially isolated	Reduction in quality of life for people in warm areas without appropriate housing; impacts on the elderly, very young and poor
Heavy precipitation events. Frequency increases over most areas	*Very likely*	Damage to crops; soil erosion, inability to cultivate land due to waterlogging of soils	Adverse effects on quality of surface and groundwater; contamination of water supply; water scarcity may be relieved	Increased risk of deaths, injuries and infectious, respiratory and skin diseases	Disruption of settlements, commerce, transport and societies due to flooding: pressures on urban and rural infrastructures; loss of property
Area affected by drought increases	*Likely*	Land degradation; lower yields/crop damage and failure; increased livestock deaths; increased risk of wildfire	More widespread water stress	Increased risk of food and water shortage; increased risk of malnutrition; increased risk of water- and food-borne diseases	Water shortage for settlements, industry and societies; reduced hydropower generation potentials; potential for population migration
Intense tropical cyclone activity increases	*Likely*	Damage to crops; windthrow (uprooting) of trees; damage to coral reefs	Power outages causing disruption of public water supply	Increased risk of deaths, injuries, water- and food-borne diseases; post-traumatic stress disorders	Disruption by flood and high winds; withdrawal of risk coverage in vulnerable areas by private insurers; potential for population migrations; loss of property
Increased incidence of extreme high sea level (excludes tsunamis)[c]	*Likely*[d]	Salinisation of irrigation water, estuaries and fresh-water systems	Decreased fresh-water availability due to saltwater intrusion	Increased risk of deaths and injuries by drowning in floods; migration-related health effects	Costs of coastal protection versus costs of land-use relocation; potential for movement of populations and infrastructure; also see tropical cyclones above

Notes:
a) See WGI Table 3.7 for further details regarding definitions.
b) Warming of the most extreme days and nights each year.
c) Extreme high sea level depends on average sea level and on regional weather systems. It is defined as the highest 1% of hourly values of observed sea level at a station for a given reference period.
d) In all scenarios, the projected global average sea level at 2100 is higher than in the reference period. The effect of changes in regional weather systems on sea level extremes has not been assessed. *{WGI 10.6}*

Source: IPCC 2007a.

Gains in agricultural yields must also be weighed against projected population growth. In 2004 the UN projected a global human population of 8.9 billion by 2050, up from 6.1 billion in 2000. This represents a 45.9% increase of population between 2000 and 2050.

With an increase of only 5 to 20% in global agricultural yields (IPCC 2007a), food production will clearly become an increasingly pressing concern. Given that there were already an estimated 1 billion calorically undernourished people worldwide in 2009 (FAO 2009), climate change represents a considerable problem for global food security.

Climate Change Impacts on Agriculture in Canada and BC

In Canada and British Columbia, climate change is being seen by many as largely positive for agriculture, providing a longer growing season due to milder temperatures. However, arid areas of BC will likely face increased pressure on agriculture due to water scarcity and crop damage from extreme heat events (Lemmen and Warren 2004; Walker and Sidneysmith 2007). Two reports from Natural Resources Canada discuss the possible changes for Canadian and British Columbian agriculture; Lemmen and Warren (2004) summarize the potential positive and negative impacts for Canada in the figure below.

Walker and Sidneysmith (2007) describe the opportunities for agriculture in BC, explaining that milder winter temperatures would result in a longer growing season, thereby increasing the range of many viable crops. While constraints exist, such as soil suitability, water supply and transportation distances to market, they predict that

> Isolated valleys of quality agricultural land (e.g. Bella Coola valley) may be the greatest beneficiaries. Introduction of new and potentially more lucrative crops into existing agricultural regions has also been considered, although these perceived opportunities will face development and water availability challenges similar to those that currently face existing crops, with added risks as a result of climate change (Walker and Sidneysmith 2007).

While the authors acknowledge potential concerns, their overall prediction is that climate change will benefit agriculture in British Columbia. They go on to explain that farmers have experience dealing with climate variability, market fluctuations and other agricultural uncertainties, and that with appropriate support programs they could adapt to

changing climate conditions (Walker and Sidneysmith 2007). However, given the challenges faced by many Canadian farmers discussed in the previous chapter, this may be an optimistic view.

While the authors paint a largely positive portrait of the impacts of climate change on British Columbian agriculture, they do recognize some negative consequences of climate change on food security, particularly for water scarcity. They explain that

> The greatest threat to agriculture from climate change in BC is the impact on water resources. This results not only from increasing water scarcity and extended drought, but also from heightened competition with other uses. Increases in extreme weather, associated natural hazards, and outbreaks of pests and disease are also of concern (Walker and Sidneysmith 2007).

The semi-arid valleys of BC's interior will be particularly affected by water scarcity. The interior contains a significant proportion of BC's agricultural land (approximately 36% of all Agricultural Land Reserve) (ALC 2009e). Furthermore,

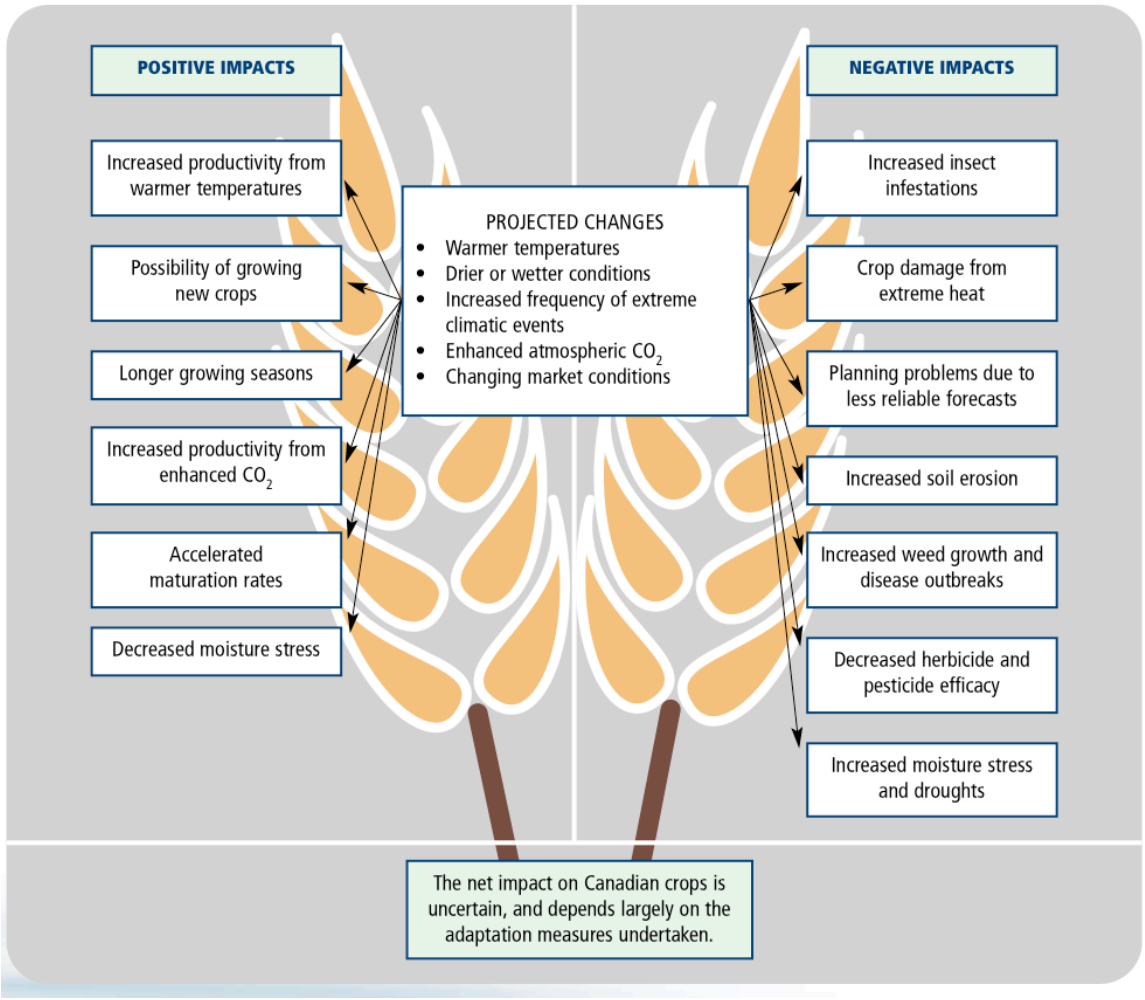
> Climate change will affect access to food resources, particularly for rural and First Nation communities that rely on hunting, trapping, gathering and fishing for subsistence … thus exacerbating existing food insecurities (Walker and Sidneysmith 2007).

BC stands to lose key food production capacity in the form of indigenous species, particularly fisheries such as the Pacific Salmon. This loss will impact BC's GDP, employment in the province and the contribution of indigenous foods to the cultural, social and dietary needs of Aboriginal and non-Aboriginal people (Walker and Sidneysmith 2007).

Although Figure 3.1 shows a balanced perspective on the impacts of climate change on Canadian agriculture, the statement that "The net impact on Canadian crops is uncertain,

and depends largely on the adaptation measures undertaken" reflects the uncertainty around the real impacts of climate change. The recent weather-related loss of crops in the Fraser Valley in the fall of 2010 shows the significant impact that one unusual climate event can have on major agricultural region of BC (Raphael 2010) and reveals either inadequate adaptation measures or none at all.

Figure 3: Potential Impacts of Climate Change on Crops in Canada



Source: Lemmen and Warren, 2004.

The focus of Walker and Sidneysmith's work is BC's adaptive capacity in face of climate change, with agriculture as a key focus; however, their optimistic view that climate change will benefit BC agriculture is based on the premise that adaptation will remain a possibility. With a rise in energy costs, however, the cost of adaptation will likely

increase, further increasing the possible climate-related pressures on agricultural producers. Walker and Sidneysmith also do not consider the larger question of food security in British Columbia. As noted previously, BC is connected to the global food system through our dependence on imports (BC MAL 2007). Other key agriculture areas supplying BC could face pressure from climate change (IPCC 2007a). The United States, for example, supplies a significant amount of food for BC (BC Stats 2000). However, the future of American agriculture is uncertain. Various climate scenarios for California, for example, all imply a degree of food scarcity (Cavagnaro, Jackson and Scow 2006).[13] This will likely increase the pressure to produce more food in BC (BC MAL 2007). However, given that only about 950,000 hectares of land in BC is capable of supporting a wide range of crops (BC Stats 2010a), it is questionable whether current agricultural practices can meet the needs of our current population (BC MAL 2007), let alone future population growth.

3.2.2 The Energy-Agriculture Nexus

In addition to the climate crisis, our agricultural system faces another threat. Agriculture's heavy dependence on oil means that global peak oil has significant implications for the future of our food system (I-SIS 2005). Agriculture's high dependence on energy inputs and its capacity to supply bioenergy has created what the United Nations' Food and Agriculture Organization has called 'the energy and agriculture nexus.' (FAO 2007). Our food distribution systems are heavily fossil fuel dependent and, in the context of both climate change and peak energy, unsustainable (I-SIS 2005). However, a growing response to oil scarcity (and climate change) is the attempt to shift to biofuels to supplement fossil fuel use. This represents a significant threat to global food security, as biofuel crops compete with conventional crops for land and boost food and fossil energy prices (Lehtonen 2007). Global food production will likely experience considerable pressures in the 21st century due to energy shortages for two reasons: intensive agriculture's fossil-fuel dependence, and increasing competition for agricultural land to produce biofuels rather than food. As BC produces less than half of its own food (BC MAL 2007), this will significantly impact BC's food security.

[13] Canada may well export bulk water to regions such as California that could face increasingly arid climates. This would create a new set of economic and ecological challenges for all Canadians.

Peak Energy and Unsustainable Agricultural Practices in Canada and BC

Emphasis on local food production has declined in recent years in favour of larger-scale agricultural operations and imports (de la Salle 2004; BC MAL 2007). The sustainability of these practices must be questioned not only because of climate change, but because of increasing energy scarcity (Duncan and Youngquist 1999; Hirsch 2005). Large-scale food production in the United States and Canada is highly dependent on fossil fuels: fossil energy uses range from components of fertilizers and pesticides, to the fuelling of production fleets (e.g., tractors and combines) and transportation fleets to ship the goods (Duncan and Youngquist 1999; Agriculture and Agri-Food Canada 2008b). Energy shortages due to peak oil would seriously compromise our ability to continue producing and transporting low-cost food through the industrialized techniques currently applied today (Pimentel *et al.* 1973; Duncan and Youngquist 1999; Laidlaw 2004; I-SIS 2005; Heinberg and Bomford 2009).

Figure 4: Industrial Agriculture's Dependence on Oil

- 10 energy units are spent for every energy unit of food on our table
- 1000 energy units are used for every energy unit of processed food
- 17% of the total energy use in the United States goes into food production & distribution, accounting for more than 20% of all transport within the country; this excludes energy used in import & export
- 20% of all greenhouse gases in the world come from current agriculture

Source: Adapted from I-SIS, 2005.

These trends show that agriculture is becoming less efficient in terms of crude energy returns on energy invested (EROEI). Laidlaw (2004) explains that for every calorie of fossil fuel the average American farm consumed in 1940, it produced 2.3 calories of food energy. Today, however, that the ratio is reversed, with 3 calories of fossil fuel consumed for every calorie produced (Laidlaw 2004). The EROEI on agricultural has therefore shifted from 2.3:1 to 1:3 in 2004, rising to 1:10 when processing and

transportation is included (Box 3.1). As agriculture industrializes, we see a shift from a net energy gain through agriculture to a net energy loss.

As in other parts of Canada, BC's agricultural sector is heavily energy-dependent (Natural Resources Canada 2007),[14] though it is not currently possible to calculate the EROEI for food and agricultural products in BC. In 2001, BC farmers produced 48% of the total food consumed in the province (BC MAL 2007). Transportation therefore plays a strong role in ensuring BC's current level of food security.

Canadians and British Columbians are therefore 'eating oil' at every meal. Given the likelihood of increased energy costs due to peak oil (Duncan and Youngquist 1999; Hirsch 2005), food security in import-dependent BC will probably face increasing pressures. Moreover, these pressures may be exacerbated by attempts to address energy insecurity.

Biofuels and the Competition for Agricultural Land

Unfortunately, an increasingly common response to declining oil stocks is the promotion of biofuels: proponents cite ecological and economic reasons to use biofuels as a replacement for conventional oil sources (Jordan, Boody et al 2007). However, there are a number of reasons why biofuels may in fact pose a significant threat to global food security if broadly pursued (Lehtonen 2007). Despite the many arguments against the use of biofuels, including the very small energy gains made through the production (Pimentel and Patzek 2005; Rajagopal *et al.* 2007), transportation and consumption lifecycle, the most pertinent critiques for the purposes of this paper are the potential impacts on communities, food production and food prices.

[14] While this energy total includes BC, the Yukon and the Northwest Territories, the vast majority of landscape under agricultural production, and therefore the energy use required for that production, is in British Columbia. As of 1996 NWT had 23 farms, with 562.9 hectares under cultivation (Territorial Farmers Association 2000), while the Yukon currently has 5400 hectares under crop cultivation (Yukon Ministry of Energy, Mines and Resource 2008). In 2001, with nearly 2.6 million hectares in BC actively farmed (Statistics Canada 2007b), the vast bulk of the energy use in agriculture in BC and the Territories would have been in BC.

With a rising demand for biofuels, and its increasing subsidization, the competition for food land and energy land will grow. Brazil, for example, is one of the few major countries to have experimented on a large scale with biofuels. Currently, about 6 million hectares are currently cultivated for ethanol sugarcane. By 2025 the Brazilian government hopes to increase this fivefold to 30 million hectares. Though there are claims this can be done without competing for food production land, it is likely that resources and labour will both be diverted away from food, if ethanol production remains profitable. However, ethanol only remains profitable due to significant subsidies to the industry (Lehtonen 2007).[15]

Along with environmental, agricultural and social concerns around the production of biofuel, there is strong evidence that biofuels offer at best marginal EROEI. As this paper deals largely with social impacts of food production and agriculture, there is no room here to weigh the evidence regarding the potential net energy gain through biofuels; however, while sugar cane ethanol has net energy gains (De Oleivera *et al.* 2005), the corn-based biofuels currently being pursued in the United States are critiqued for net energy loss, or at best marginal energy gains (Pimentel and Patzek 2005; Rajagopal *et al.* 2007). Some studies suggest that a minimum desirable EROEI is 5 to 1 (Hall 2008), and the types of biofuels currently being pursued in North America currently fall well short of this goal. Biofuels also do little to achieve climate change goals when used as an alternate source of energy (Rajagopal *et al.* 2007).

Finally, increasing demand for crops to be turned into fuel, rather than used to feed people, is already affecting prices of staple crops globally. Between 2002 and 2008 average food prices have risen 140%, with some staples increasing much more. A leaked World Bank report estimates that 75% of the dramatic rise in prices can be directly attributed to increasing demand for biofuels (CBC 2008). This highlights the truly detrimental impacts of biofuels on vulnerable populations. The Harper administration in

[15] Furthermore, this program, especially in its initial phases, perpetuated long-standing class inequalities where subsidies to sugar cane plantations benefited the rich, while doing nothing for the abysmal working conditions of the labourers (Lehtonen 2007). Though beyond the scope of this thesis, social justice for farm workers remains important considerations in weighing the value of biofuels and all agriculture.

Canada, however, has pledged funding to biofuel producers (Office of the Prime Minister 2007); there is therefore a strong likelihood that food production and energy production will be in direct competition in 21st-century Canada. Should Canada continue to pursue a significant biofuel industry, the competition between land to produce food versus land to produce energy could well become a major concern.

3.3 Crises Converging: Impacts of Climate Change and Peak Oil on Food Security

> Either we adapt with deliberate process or have these changes forced on us with damaging repercussions (Odum 2001).

Globally, nationally, provincially and locally, we are facing climate and energy crises whose significance will affect every aspect of our daily lives (Duncan and Youngquist 1999; IPCC 2007). One indication of the type of impact climate change and peak oil may have came with the 2007-08 global food crisis. With the significant increase in food prices, food security became a central topic for many countries. In 2010 extreme drought and fires in Russia "prompted the country to impose an export ban on wheat, and has led to a major increase in global wheat prices in the face of reduced output" (Lee *et al.*, 2010). Climate change and peak oil are almost certain to detrimentally impact food security in British Columbia, as imports become more expensive and potentially scarce. Unless our planning strategies accept this new reality and incorporate it into the way we plan for food security, the likelihood of a worldwide food crisis could be the very sobering reality we face (Odum 2001).

However, as I discussed in the previous chapter, the trend in Canada is toward greater consolidation and vertical integration of the food system, fossil-fuel dependent technologies and largely unsustainable practices. This move toward bigger farms and vertical integration promises lower agricultural commodity prices in the short term. This promise of low prices could be used to further encourage agricultural economies of scale as energy prices rise and agricultural production is affected by climate change. However should we pursue industrial agriculture wholesale, we will inevitably adversely impact

small and medium-scale farmers in Canada and BC (Qualman and Tait 2004). As these farmers are priced out of the market, we undermine an agricultural system that I will argue in the following chapters is our best prospect for a sustainable food system in light of both climate change and peak oil.

In BC, with a significant agricultural history and abundance of small and medium-sized farms, there is a potential for significant leadership in adapting to these impending crises. An increased demand for local food production due to higher-priced imports (BC MAL 2007) is not a certainty, but is very likely. This scenario could prove disastrous, or it could provide an incentive to shift to more sustainable forms of food production. In order to do so we need to protect BC's small and medium-scale farmers. However, these farmers currently face a host of threats that are ecological, economic and socio-political in nature.

4. Barriers to Independent, Small-Scale Food Production: Existing and Emerging Concerns for Food Production in BC

In chapter two I critiqued our current food system, challenging the current trend toward consolidated, industrialized agriculture in Canada from social, economic and ecological perspectives. Vertical integration of the food system concentrates power over this basic need in the hands of a few (Shiva, 2002; Shand 2002). Moreover, as discussed in chapter three, the two emerging challenges of climate change and peak oil, will significantly impact food production, processing and transportation worldwide and here in British Columbia: climate change and peak oil (IPCC 2007; Walker and Sidneysmith 2007; Duncan and Youngquist 1999; Hirsch 2005). As the consequences of climate change and peak oil are felt more strongly in the 21st century, BC's agricultural system will be required to adapt, possibly creating a stronger demand for agricultural goods produced within the province (BC MAL 2007).

As discussed in chapter three, BC's agriculture currently meets less than half of our food needs. Increasing uncertainty, BC's farmers face a range of ecological, social and economic challenges to their success, which are discussed throughout this chapter. The discussion synthesized from the work of a number of agricultural initiatives undertaken at the local—usually regional district or community—level. These initiatives provide an important set of qualitative data regarding the state of food production in BC—the direct experiences of farmers, concerned community members and local agricultural stakeholders. If the need for local, regional and provincial food production grows throughout the 21st century, understanding and addressing the challenges expressed in these various reports will be central to ensuring food security in the face of new global challenges.

4.1 Ecological Challenges

BC's farmers face the same types of ecological pressures faced by farmers around the world: soil erosion, water availability and environmental damage from poor agricultural

practices. These environmental limitations must be addressed in some form to ensure the long-term viability of BC's food system.

4.1.1 Local Environmental Limitations

While soil erosion is a consequence of industrial farming practices, it remains a concern even for small-scale farmers. In several agricultural regions of British Columbia, farmers have noted the decline of soil quality. For example, the Community Food Action Initiative's Community Food Security Public Consultation Meeting Summary for the Cowichan Valley noted that soil quality is declining, though there was no discussion of why (Cowichan Green Community 2008), while in Prince George environmental problems due to poor manure management and poor drainage are a major concern (Connell *et al.* 2007). As discussed in chapter one, soil degradation results in lower yields and represents a significant threat to global food security.

Water availability is also a major concern for agricultural producers in some parts of British Columbia. For example, in Quesnel at least one farmer has run out of water and others are pressured by shortages (Connell *et al.* 2007). Participants in Salt Spring Island's area farm plan (Masselink, 2008) public consultation voiced concerns regarding the limited availability of water. The summary of the public process noted that

> The availability of good quality water throughout the growing season is a constraint for many Salt Spring Island farm operations. There is a limited (and possibly diminishing) supply of quality groundwater and growing competition from non-farming uses. Other issues include the acquisition and distribution of water, and water collection and retention (Masselink 2008).

This shortage of water is also felt in the Cowichan Valley, where the North Cowichan Strategic Agricultural Plan states "There is a water deficit for production during the summer months. Farmers do not have assured access to water, even though their land is in the ALR" (District of North Cowichan 2001). These examples are the local result of another aspect of what agricultural producers are experiencing globally. In the "World Scientists' Warning to Humanity," UCS warns that "Heedless exploitation of depletable ground water supplies endangers food production and other essential human systems"

while “Loss of soil productivity … is a widespread by-product of current practices in agriculture and animal husbandry” (UCS 1992)

BC’s food security therefore faces environmental limits to current food production that may reduce future agricultural yields. While these limitations could be circumvented through increased industrialization of agriculture in the short term (e.g. artificial fertilizers to improve soil productivity, transportation of water), over the long term the viability of these strategies is called into question by peak oil. The limitations currently facing producers in BC may be exacerbated by climate change in the future, as discussed in chapter three. Furthermore, these limitations point to the possibility of a local experience of global overshoot: British Columbia’s agricultural producers may be feeling the consequences of humanity’s broad and heavy ecological footprint.

4.2 Economic Challenges

The current economic climate has also made conditions unfavourable for small-scale agricultural producers in BC. The policies designed to protect them – such as protection of the Agricultural Land Reserve – have been significantly eroded in recent years, and market forces such as development and rising land prices are making it more difficult to maintain a livelihood through small-scale agricultural production. These trends will contribute to greater food insecurity in BC unless stemmed: small-scale producers provide 50% of BC’s farm sales and unfavourable economic conditions for them mean less food will be produced by independent BC farmers in the future (SmartGrowth BC 2008).

4.2.1 Loss of Agricultural Land Reserve

B.C.’s unique Agricultural Land Commission (ALC) is an independent Crown body, created in 1973, that oversees the provincially zoned Agricultural Land Reserve (ALR) throughout the province. Their mission statement is to “preserve agricultural land and encourage and enable farm businesses throughout British Columbia” (ALC 2008). The ALR currently consists of about 4.7 million hectares, or about 5% of B.C.’s land and freshwater area (ALC 2008).

While there has been no net loss of ALR land in the more than 30 years since its creation, the Agricultural Land Reserve continues to be threatened, particularly those pieces of land close to urban areas. Furthermore, high quality soil is present in only 1% of all ALR land and this is largely in the Lower Mainland, Okanagan or on southern Vancouver Island (ALC 2008).[16] It is these areas that are most at risk from development (ALRPEC 2005). Between 1975 and 2009 these three regions lost a combined total of 37 379 ha from ALR land (ALC 2009d). The ALR has seen no net loss due to the shifting of agricultural protections to northern regions, such as the Peace River, Bulkley Nechako and Fraser-Fort George. At designation these areas had 2.10 million hectares of ALR. As of 2009 these three regions had a total of 2.22 million hectares, a gain of more than 124 000 ha (ALC 2009d). These areas, however, have significantly poorer soil quality than the regions where ALR is being reduced (SmartGrowth 2008). The constancy of the ALR area therefore marks an overall decline in average land quality.

It is also worth noting that while simple land-area counts are a general indicator of agricultural activity, they are not always precise measures. ALR land is often dedicated to non-agricultural activities, such as transportation corridors, institutions, and golf courses (Govender *et al.* 2006). Development and an increasing number of non-agricultural activities on ALR land therefore threaten the viability of local agriculture by reducing the land base available for small-scale producers, and potentially diverting necessary resources away from agricultural activities.

This concern has been voiced by a number of communities in B.C. through public processes that are attempting to address food security concerns. The North Cowichan Strategic Agricultural Plan (2001), for example, notes that if agriculture continues to decline in the Cowichan Valley, land could be removed from the ALR for non-agricultural purposes. In Richmond 1 900 hectares of approximately 4 900, or 39%, is

[16] While the ALR gained 44,187 ha between 1974 and 2008 (ALC 2009c), as of March 31, 2009, significant net exclusions have occurred in prime agricultural land, including Capital Regional District (2 530ha), Central Okanagan (6 997ha), Comox-Strathcona (2 934ha), Cowichan Valley (4 263ha), Fraser Valley (4 979ha), Greater Vancouver (5 974ha), Nanaimo (2 590ha), Okanagan-Similkameen (2 721ha) and North Okanagan (4 391ha) (ALC 2009d). However, these areas represent the most productive agricultural land in the province (SmartGrowth BC 2008).

either vacant or dedicated to non-agricultural activities; however, this is only slightly higher than the provincial average of 34% of ALR land dedicated to non-agricultural purposes (Govender *et al.* 2006). It is difficult to determine causality in this case: whether the removal of ALR leads to the decline of farming or vice versa. Likely they are mutually reinforcing trends. Regardless of the cause, however, the removal of farmland from the ALR reduces BC's future capacity to produce its own food.

While Cowichan and Richmond represent extremely important areas of the ALR because of high soil quality and development pressures, more remote communities are also expressing concern over loss of ALR land. In a report on agricultural land-use planning in Prince George and Quesnel, the authors noted that "The approval of non-agricultural use on and subdivision of ALR land are of particular concern" in Prince George, and that "expanding rural residential areas are increasing pressure on ALR land in the Prince George area." While less of a concern in Quesnel, commercial development "has consumed some ALR land" (Connell *et al.* 2007).

These case studies reflect increasing pressure on the ALR, from commercial and residential development as well as the use of ALR land for non-agricultural purposes. This increasing pressure on the ALR threatens agricultural production by diminishing both potentially productive and active ALR land. Furthermore, because most farm sales total less than $10 000 annually (SmartGrowth BC 2008), it may become economically preferable for farmers or developers to either dedicate ALR land to non-agricultural purposes or attempt to remove it from the ALR. Indeed, threats to ALR land due to development and non-agricultural activities also link with a second major economic concern for BC's producers: rising land prices.

4.2.2 Rising Land Prices in BC

Another major economic challenge facing agriculture today is the rising price of land. BC's comfortable temperate climate and beautiful scenery combine to make it a highly desirable place to live. With a population increase since 1991 of nearly 1.1 million people, BC's population growth shows no signs of slowing (BC MAL 2007). This is an issue not only in the Lower Mainland, which grew 6.5% between 2001 and 2006, to

2 116 581 people, but all over BC (BC Stats 2010b). This population boom, while itself a concern for regional food security, has also driven land prices up, making it difficult for farmers without existing access to land, to purchase farmland. A number of agricultural communities have identified this challenge as a key concern for agriculture in BC.

On Saltspring Island land prices emerged as one of the major threats to local agriculture during their AFP public consultation. The public process notes state that "The beauty and climate of the West Coast and Salt Spring Island coupled with a strong real estate market is resulting in an increasing demand for residential island properties. The interest in island living has resulted in substantial increases in the price of all island properties, including farmland. As a result, the price of agricultural land is prohibitive for new farmers" (Masselink 2008)

This concern is echoed by a number of other communities throughout BC. In the Cowichan Valley, high-priced homes on agricultural land make it economically unfeasible for new farmers to purchase land (Cowichan Green Community 2008). Meanwhile in BC's Capital Regional District, "Accessing agricultural land in the Capital Region has become increasingly difficult for farmers, particularly those just starting out. The value of real estate in the Region has sky-rocketed and in many areas developments are continuing to sprawl onto agricultural land. As the pressures on agricultural land have grown, rural property prices have increased to the point where those who wish to farm can no longer afford to purchase land" (McNair 2004).

While the communities expressing concern over land prices are currently predominantly southern communities, economic activity in BC's northern communities is growing due to oil and gas exploration. This activity is particularly prevalent in the Peace River area, which currently includes 50% of ALR land (SmartGrowth BC 2008). This may increase concerns around land prices and development, affecting agricultural productivity, for both new farmers purchasing land and established producers, as they retire and attempt to sell their land while ensuring it stays agriculturally productive. Finally, affordability

remains a key issue for all agriculture producers because of another key concern: the lack of profitability in farming.

4.2.3 Un-Profitability

Smart Growth BC notes that most farmers rely on a second income for the bulk of their annual earning. This is not surprising given that sales on 50% of farms average less than $10,000 a year (SmartGrowth BC 2008). A number of communities cite the lack of profitability in farming as a central stumbling block in the development of local agriculture.

Saltspring Island, in their Area Farm Plan consultations, identified this key area as a major concern. The public process notes state that "There is an overwhelming agreement that farming on Salt Spring is generally no longer a financially profitable business." Many reason[s] for this were provided including: higher input and operating costs – directly a result of increased transportation costs; the high cost for labour and lack of housing on Salt Spring; higher capital costs and resulting debt loads. These costs make it difficult to compete with off-Island producers that have lower costs and/or supportive subsidies" (Masselink 2008).

In Cowichan Valley's Strategic Agriculture Plan (2001) three concerns around profitability are identified: the cost of inputs, production of low-value commodities, and marketing. The report notes that most agricultural inputs are imported to Vancouver Island, increasing their already significant cost. This combined with significant land and capital costs for agriculture mean that pre-production costs are significant. Another major factor affecting profitability of agriculture is the tendency, not only in the Cowichan Valley, toward the production of low-value agricultural commodities: large areas of land are dedicated toward hay production, rather than high-value commodities. Finally, marketing is a significant concern: local bulk retailers are viewed as unsupportive of local producers, and farmers themselves generally lack marketing abilities and opportunities to sell high-value commodities if they are produced (District of North Cowichan 2001).

These local concerns around agricultural profitability are further exacerbated by cheap, imported foods. As community members in Bella Coola point out, the prevalence of these goods has significantly affected local agricultural production in their region, and remains a significant block both to the profitability of local agricultural goods and to the sustainability goals set forth in the report: to reduce fossil-based practices by supporting local food production (Bella Coola Valley Sustainable Agricultural Society 2006). Moreover, the availability of these imported (junk and processed) foods is linked to a decline in the consumption of traditional foods and the rise in nutrition-related diseases.

Profitability, then, is a central problem in promoting local agriculture for many of BC's communities. The other two economic challenges to local production, the threat to ALR land from non-farm uses and affordability of land, might both be at least partially addressed if agriculture in BC were more economically viable. This however, would require significant shifts in global trade policies that would see food priced to reflect many hidden costs, both in terms of subsidized fossil fuel consumption and externalized environmental damage.

4.3 Socio-Political Challenges

Finally, BC's small-scale producers face important socio-political challenges to their work. Restrictive regulations, a loss of farming culture and conflict between suburban residents and farmers all represent significant challenges for food security in British Columbia. They also represent an undervaluation of agricultural producers in British Columbia: while we all depend on food, we consistently, whether through regulation or culture, fail to consider the importance of food producers.

4.3.1 Restrictive Regulations and a Lack of Provincial and Federal Support

A number of communities engaged in food planning processes around BC identified restrictive regulation, particularly affecting small-scale producers, as a key challenge limiting the capacity of local agricultural producers. This range of regulatory issues includes everything from ALR restrictions on construction, to food processing regulations, to existing zoning bylaws and local tax policies. The most recent legislative

concern facing small-scale producers is the implementation, in September 2007, of the new *BC Meat Inspection Regulations*, which effectively limit the ability of small-scale, rural producers to profitably and legally supply meat to local purchasers. Many current regulations are, at best, unsympathetic to small-scale producers, exacerbating some of the economic challenges, such as profitability, discussed above (Masselink 2008).

Recent legislation regulating abattoirs and meat production in BC is particularly controversial. As of September 30, 2007, BC's *Meat Inspection Regulations* came into effect, functionally limiting the ability of small producers to butcher and distribute their own meat. These regulations represented the provincial government's response to incidents of food-borne illnesses in meat processing plants (BC MHLS 2010).[17] These regulations required significant upgrades in existing abattoir facilities all over the province. Prior to this legislation, producers outside the Lower Mainland and the more heavily populated areas of southern BC were legally allowed to slaughter their meat for farm-gate sales. This legislation required producers everywhere in BC are required to process all meat at a provincially licensed facility. Any meat animal, in order to be legally slaughtered, had to be shipped to an existing licensed facility. However, given the limited capacity of many rural communities to build new facilities or renovate existing ones, this was an expensive prospect for many farmers who need to ship off-island (Edible Strategies 2007). In September 2007 there were 16 licensed facilities, with 20 more facilities undergoing licensing procedures. The majority of these are located in the Lower Mainland or other parts of Southern BC (Farmers' Institutes and CAA 2007). Recently, the provincial government has recognized the impact that these regulations have had on local meat producers, introducing legislation creating two new licensing categories for isolated, small-scale farmers (BC MHLS 2010). While this legislation represents a welcome reprieve for many small-scale meat producers, it is uncertain how it will affect small-scale farmers, and does little to address the small-scale farmers and

[17] It should be noted here that two recent, highly publicized incidents of food borne illnesses both occurred due to cleanliness issues with major meat processors. The listeria outbreak of 2008 occurred at a major Maple Leaf Packing plant in Toronto (CBC 2009). A more recent recall of meat products covered over a hundred products processed by Brandt Meat Packers Ltd. (National Post 2010). Arguably, industrial-scale processing plants pose a more significant threat to food safety in Canada than properly trained, responsible small-scale meat producers, as the possibility of widespread illness is much greater, due to the scale and volume of processing that occurs at these plants.

butchers, possibly numbering the hundreds, who have had to shut down due to high operating costs imposed by the legislation (Pablo 2008).

Participants in Saltspring Island's first community consultation for their area farm plan came up with a significant list of regulatory roadblocks to the promotion of local agriculture. These include "Regulations and policies that are problematic for small farmers include: restrictions on such activities as the construction of on-farm buildings; the pursuit of community agriculture activities within publicly-owned lands; food processing regulations; the structure of current zoning bylaws; and local tax policies." Residents and producers also expressed frustration with a lack of concern from governmental representatives and bodies, both at the local and provincial level. More frustrating than the limitations imposed on them was the denial of opportunity to voice their concerns in any officially recognized way. While the abattoir regulations were relatively new at the time of the Saltspring Island consultations, there was concern among the island's farmers that meat producers would be forced to either stop operating (Masselink 2008).

Two key regulatory concerns were identified in North Cowichan's Strategic Agricultural plan. The first, ironically, deals with environmental regulations. Some local farmers found environmental regulations too restrictive. Thus, the regulations designed to help maintain long-term environmental health and productive viability, both of a farm and its surroundings, were found by farmers to be detrimental in the short term by raising operating costs. The second challenge identified by local farmers dealt with planning regulations and bylaws that "do not establish sufficient separation between agriculture and new development or incompatible land uses" (District of North Cowichan 2001).

Provincial, federal and even local legislation can pose significant limitations to sustainable small-scale production; it is also clear that these regulatory challenges are deeply implicated with some of the economic concerns discussed above. For example, abattoir regulation impacts the profitability of small-scale producers. This regulatory framework, then, reflects the fact that the issues discussed here are, in fact, not simple, one-off challenges to be dealt with individually, but singular aspects of a larger, systemic

resistance to the promotion of small-scale, sustainable food production. Indeed, as farmers on Salt Spring noted, "The focus of federal and provincial agricultural policy and financial subsidies is visibly centered on the demands and interests of large-scale agri-business" (Masselink 2008).

These challenges represent part of a much larger series of provincial, national and international trade policies; these policies favor a particular neo-liberal economic agenda that offers little benefit for small communities and re-localization movements, in BC and abroad.

4.3.2 Declining Farm Population and a Loss of Farming Culture

A number of communities cited the devaluation of the farming lifestyle, or a lack of new farmers, as another key concern regarding the future of small-scale production. Due to some of the economic concerns cited above, agriculture is considered undesirable as a profession. Furthermore, the culture of farming is disappearing, as multi-generational farms become fewer and further between; knowledge about land and agricultural techniques is consequently disappearing as older generations retire with no generational turnover.

Farmers in Nanaimo cited the future as one of their seven major concerns about maintaining and promoting local agricultural production. This topic covers a range of concerns, from purely practical production concerns, to more significant concerns about lifestyle and tradition. Farmers in the Nanaimo area expressed concern about what would happen when they retired, given the lack of interest around farming from their children's generation. "[E]ven traditional farming families had concerns about passing on the farm to the next generation" (Patel 2006). Moreover, the difficulty finding new farmers, even as paid staff, was another major concern (Patel 2006).

On Salt Spring, participants in the Salt Spring Island Area Farm Plan process echoed these concerns. Participants noted "the high cost of land, the poor financial outlook, the lack of training opportunities and the lack of interest in the farming lifestyle" (Masselink

2008). Another major concern participants expressed was the loss of farming culture: as with Nanaimo, Salt Spring residents felt there was serious decline of multi-generational farms on the island (Masselink 2008).

These concerns, the lack of new farmers and loss of farming traditions, represent two important issues for small-scale agriculture. The first is primarily productive: without new farmers, small-scale production will become a thing of the past, resulting in fewer viable small-scale, sustainable farms. The second is a larger cultural issue. Agriculture represents a significant aspect of Canadian and British Columbian settler history. If older farming generations retire or pass away without successors, we risk losing not simply productivity, but the knowledge base that allows us to feed people with local food, just as changing global conditions suggest we may need it.

4.3.3 Misunderstandings About Small-Scale Agriculture

A final socio-political concern raised by a number of communities is the lack of public information regarding agricultural issues and growing misunderstanding between the public and farmers. Many farmers see local governments and citizenry as uninformed about issues facing local producers. In some cases this perhaps valid perception results in conflict between farmers and their neighbours, regarding land-use issues and aesthetics.

A number of agricultural producers have stated that members of the public were uninformed about the nature of small-scale, sustainable, local production. In Nanaimo, for example, "Farmers felt that a good deal of their time involving sales was spent in educating customers about food quality, freshness and price; about the hidden costs of cheap, long distance food; about sustainable, ethical farming practices and seasonally available foods, and about the growing/raising practices of large agri-businesses" (Patel 2006). Moreover, farmers felt that many members of the public have lost their connection to the food system, and had little or no concern about the issues facing local farmers (Patel 2006; Masselink 2008). This sentiment was also voiced on Saltspring, where participants at the AFP meetings noted that a lack of education can result in

> people not recognizing the true cost of producing food locally, customers' unwillingness to pay more for local food, a lack of understanding of the economic plight of small farms, the public not appreciating the multiple benefits (social, community, environmental) of local food production, consumer buying habits and expectations of all foodstuffs being available year-round, and lack of concern about how global environmental and economic changes may impact local systems (Masselink 2008).

This lack of education not only results in an indifference toward food production in general, and its importance, but can also lead to interpersonal conflicts. On Saltspring, a major concern AFP participants cited was conflict with new neighbours. With a growing population and an abundance of new residents, farmers feel increasing pressure from "residential property owners over such issues as noise, water use, water quality and smells" (Masselink 2008). These concerns represent a significant challenge, as traditionally rural areas see an increasing number of urbanites taking up rural residence. This particular concern represents the social component of the development pressures facing agricultural producers: while development threatens ALR land physically, the new residents occupying these developments may be unfriendly toward local agricultural producers.

4.4 Letting our Farmers Down: Threats to Independent Agricultural Producers in BC

While global ecological and energy concerns will certainly impact BC in the coming century (IPCC 2007; Walker and Sidneysmith 2007; Duncan and Youngquist 1999; Hirsch 2005), agricultural producers in this province currently face a number of pressures that put future agricultural production at risk. The uncertainty caused by climate change in particular (IPCC 2007a; Lemmen and Warren 2004) will make agricultural planning difficult. There is a strong likelihood that increased import prices will increase demand for locally produced food (BC MAL 2007) and unless we address the pressures, our food system will likely be unable to meet these demands.

British Columbia's agriculture is still composed of a relatively high proportion of small- and medium-scale farmers (Statistics Canada 2008b; Statistics Canada 2007c). However, some farms in BC are following the general trend toward bigger farms with fewer owners, while others are simply failing due to a lack of profitability. Between the censuses of 2001 and 2006, farm size in BC increased, while the number of farms decreased (Statistics Canada 2007b). The next chapter will discuss why small and medium-scale producers are vital in addressing future food needs, as they will be able to produce higher yields from small plots with the use of less inputs, particularly fossil fuels, than conventional agriculture (Sharashkin *et al.* 2005; Montgomery 2007). However, their disappearance from North America and BC means that significant political action, through appropriate governmental supports, is required to protect them, and encourage a future for them, and by extension BC's food security.

5. Food System Alternatives

In the last century Canada has a significant decline in on-farm populations and the number of farm operators. During the 20th century, farm populations in Canada declined by more than two-thirds, from over 3 million to about 1 million, between 1931 and 1976 (Basavarajappa and Ram 2008). With a current farm population of 684,260, this trend has continued into the 21st century: between 2001 and 2006 farm populations declined by 6.2% (Statistics Canada 2008a). This represents a significant demographic shift, from a national population that was one-third farming families, to a national farming population, that as of 2006, represents only 2.2% of the total. This trend is also reflected by a decline in actual farm operators. Between 2001 and 2006 the number of operators declined by 5.5% from 346,200 to 327,060 (Statistics Canada 2007b). Currently, farm operators only represent about 1% of the total national population. Despite declining farm populations and operator numbers, the area of land under cultivation has risen from 23.6 million hectares in 1931 to nearly 36 million hectares in 2006 (Statistics Canada 2007c).

This dramatic change in the number of Canadian farmers can be attributed largely to economic pressures, as the price of agricultural commodities has dropped, forcing farmers to adopt new technologies and management techniques to achieve the economies of scale required to offer competitive prices while still earning a profit (Statistics Canada 2006). However, these new technologies and management techniques bring with them a host of concerns that I have discussed in earlier chapters. While issues of intellectual property (Berry 1995; Shand 2002), public health (Goering *et al.* 1993; ILO 2000), an erosion of choice about how the food system operates (Goering *et al.* 1993; Shiva 2002) and the decline of agricultural communities (Donaldson and McInerney 1973; Berry 1995) are all important concerns regarding the health and safety of the food system, it is the sustainability of food production, particularly in light of climate change and peak oil, with which I am most concerned.

In considering the long-term sustainability of agriculture in Canada and BC I have attempted to show in previous chapters that our current form of agriculture is inherently

untenable. However, it is not enough simply to critique this food production system. This final chapter therefore aims to develop some recommendations regarding agricultural practices, developing policies that can help, rather than hinder, our farmers' success and the overarching economic paradigm in which our food system operates.

5.1 Sustainable Food Production: In Defense of Non-Industrial Production

The sustainability of our food system is intrinsically linked to the agricultural practices that conserve or sustain the soil, water and air upon which agriculture is dependent. Montgomery (2007) documents the repetition of an agriculture story wherein agricultural communities have tended toward fewer, larger farms, with centralized ownership. He argues that this story, from Mesopotamia to the Dust Bowl Days of the American mid-west, inevitably results in massive degradation of soils. With the move from subsistence agriculture to agricultural plantations, the pressure to produce for profit, rather than maintain a long-term, sustainable farm, led to the near constant cultivation of farmland. This trend meant that the soil conservation techniques of small-scale farmers were abandoned in favour of constantly productive farmland, which in turn degraded agricultural soils. Eventually these trends led to massive food imports, as in ancient Greece, Rome, medieval Europe and even the Dust Bowl states in the US during the 1930s (Montgomery 2007). As in each of these areas, today's small-scale farmers have much to teach us about producing food sustainably, with larger yields per hectare than are often seen in large scale farms (Sharashkin *et al.* 2005; Montgomery 2007).

The IPCC notes the importance of a shift toward sustainable agricultural methods:

> Improved crop and grazing land management to increase soil carbon storage; restoration of cultivated peaty soils and degraded lands; improved rice cultivation techniques and livestock and manure management to reduce CH emissions; dedicated energy crops to replace fossil fuel use; improved energy efficiency; improvements of crop yields (IPCC 2007).

However, they fail to elaborate upon successful examples of how these practices are implemented. While a shift away from large and industrial scale farming is unlikely in the near future, we need to examine examples of micro and small-scale farming, in order to see how different scales of food production can contribute to our knowledge of sustainable practices (Sharashkin *et al.* 2005).

Russia provides a unique example of micro-scale farming from which to learn about alternative modes of food production. Occupying comparable northern latitudes, Russia provides a case study climatically similar to Canada and BC in a way that case studies discussed later do not. The emerging picture of Russian food production reveals a system that, while imperfect, sees micro-farming as a "sustainable, productive and socially important practice" (Sharashkin *et al.* 2005). This practice in Russia emerges from a unique set of historical circumstances and has led to agricultural practices that are ecologically beneficial, socially important and extremely productive in terms of their contribution to the national food system. The Russian example provides evidence that sustainable agriculture is a viable alternative both when it comes to feeding people and maintaining natural capital (Sharashkin *et al.* 2005).

Historically, the Russian word *dacha* originally referred to the rural residences of the Russian aristocracy; however, within the last 60 years, the term has come to refer to the private exurban gardening plots used by urban dwellers to subsidize their diets. The food shortages of World War II led to a reversal of long-standing Soviet policies toward collectivization of rural land: in 1941 the first re-authorization of private subsistence growing occurred. In many ways, these plots represented the Soviet equivalent of North American Victory Gardens. This redistribution of land meant the allocation of small lots ($600m^2$) for urban dwellers and 'subsidiary plots' for rural dwellers of up to 0.5ha. "[B]y the late 1990s over 50% of urbanites owned a dacha, and virtually all rural residents cultivated a subsidiary plot." The rise in use of these subsidiary and dacha plots meant that at the time of the Sharashkin *et al.* study, approximately 70% of Russia's population (35 million families) was producing 40% of its total food, which provides ecological,

social and economic benefits for many of the small-scale producers producing this food (Sharashkin *et al.* 2005).

This alternative food production techniques applied in the dacha and subsidiary plots appear to use less labor than other manual farming techniques, such as slash and burn agriculture (Pimentel *et al.* 1998; Sharashkin *et al.* 2005), while productivity remains high. Additionally, these alternative practices mimic ecosystems in a way that monocultures cannot. Soil quality and biodiversity are enhanced through these techniques. In addition to the obvious benefit of allowing people to feed themselves a diverse and nutritious diet, a range of other social benefits emerge from this form of production, such as individual gains in subjective well-being, improved sense of community and a sense of connection with nature (Sharashkin *et al.* 2005).

The researchers identify these alternative agricultural practices as a form of permaculture. Permaculture "is an approach to designing and implementing small- to micro-scale systems (usually integrated with human habitat and based on patterns found in natural ecosystems), which could be sustainable and productive indefinitely with minimum inputs of labor and other resources" (Sharashkin *et al.* 2005). In some cases producers are applying the principles of permaculture without express training, while other producers explicitly espouse permaculture philosophy. Permaculture is applied in the Russian model at the dacha to subsidiary plot size (600m^2 to 0.5ha); because of the size restrictions imposed on dacha and subsidiary plots, "growers were obliged to intensify production on the little land they had available and have attained remarkable productivity" (Sharashkin *et al.* 2005)

The hallmarks of this intensive approach are the absence of machinery, no-till philosophy and the diversity of products; the result is a varied and high volume of nutritious food. While concrete yields are difficult to obtain, due to the number of plots and the variety of products, combined with the use of many plots for subsistence rather than market purposes, it is, as noted above, estimated that a significant proportion of Russia's agricultural output comes from these plots. Moreover, individual plots have been found

to have immense yields: "it is not unusual for a family of four to satisfy all of the family's needs in potatoes and other vegetables, fruits and berries and – for rural residents – milk, eggs, and meat – from the plot they cultivate" (Sharashkin *et al.* 2005). That this level of food self-reliance can be reached with an average workweek of less than 20 hours each for rural residents (Sharashkin *et al.* 2005) reflects the importance of innovative practices in small-scale agriculture.

The Russian model is of use in this thesis not because it needs to represent the future of farming everywhere, but rather because it provides one innovative response to a food crisis: a response that is low-emission,[18] highly productive, and contributes to social well-being of those engaged in it. The Russian example helps delineate some of the guidelines that should be used in shaping the future of our food system and provides a strong argument for the practical merits of permaculture. Although much of permaculture was formed around sustainable food production, permaculture itself has been defined by as

> Consciously designed landscapes that mimic the patterns and relationships found in nature, while yielding an abundance of food, fibre and energy for the provision of local needs . . . [through] the use of systems thinking and design principles (Holmgren 2007).

To this end permaculture acknowledges and aims to address many of broader ecological, economic and social issues raised in this thesis, in particular climate change, peak oil increasing vertical integration of our food system.

It should be noted that small-scale farms are no guarantee of sustainable practices. When rising populations contribute to intense food shortages, small-scale farmers, too, will succumb to pressure to keep land under constant cultivation. For example in Haiti, despite its egalitarian land distribution, farms were increasingly subdivided between several children until eventually they were too small to support subsistence farmers, and

[18] The authors note that the small-scale producers involved in this type of farming rarely, if ever, use chemical inputs such as fertilizers and pesticides, thus further ensuring a low ecological footprint from their agricultural activities (Sharashkin *et al.* 2005).

soil conservation techniques were ignored in favour of year-round cultivation (Montgomery 2007). To this end, it is important to support appropriate land-use practices as much on small farms, as on industrial-scale farms.

However, regardless of the scale of agriculture, sustainable food production must adhere to certain principles. These principles are perhaps explained concisely in the International Federation of Organic Agriculture Movements' definition of organic agriculture:

> Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. (IFOAM 2009)

The IFOAM posits that organic farming is vital to the future of food security, as it represents a practice of high sequestration, low emission food production that can contribute to both climate change mitigation and adaptation. Moreover, the IFOAM contends that organic practices can contribute to public health and poverty alleviation efforts (IFOAM 2009). Shifting from the problematic industrial model of agriculture toward an organic model of food production would do much to address the many of the concerns raised throughout this paper. Agricultural policies can encourage farmers to pursue this shift, for example through tax incentives and education efforts.

5.2 (Re)Building a Local Food Economy

As well as re-examining food production techniques to ensure sustainable practices, it is vital that BC address food access and equity issues (Hamm and Bellows 2003). Indeed, some provincial government bodies recognize this and are working to promote greater local government and community involvement in food security actions (Ross and Simces 2008). Some municipalities take this role very seriously: for example, the City of Vancouver has a strong Food Policy Council that acts as an advisory body (Mendes

2006) and conducts research into food issues in the city (Barbolet *et al.* 2005). However, in comparison to approaches taken by other municipalities and regions internationally, BC has yet to embrace fully the concept of a local food economy that provides equitable access to nutritious food: a concept that the City of Belo Horizonte, Brazil, takes very seriously.

In 1993, the newly elected municipal government of Belo Horizonte, a Brazilian city with a metropolitan population of over 2.2 million, developed a series of projects and policies aimed at reducing food insecurity in the city. Their guiding principle was "that all citizens have the right to adequate quantity and quality of food throughout their lives, and that it is the duty of governments to guarantee this right" (Rocha and Aranha 2003). These policies have since reached about 38% of the metropolitan population, but have also had significant impacts on rural sustainability. The Belo Horizonte initiatives provide a model for effective local government policy that can simultaneously address social justice and sustainability concerns (Rocha and Aranha 2003).

The municipal body responsible for Belo Horizonte's food security programming, the Municipal Secretariat of Supplies (SMAB), implemented three programming streams. The first of these generated policies focused on assisting poor families and individuals. These went beyond the emergency food programs familiar in the Canadian context, and promoted healthy eating habits through the city. The second stream of programming focused on developing partnerships with private food suppliers to expand the distribution of healthy food across the city and regulate prices of staples, fruits and vegetables. The third stream focused on increasing food production and supply, providing "technical and financial incentives to small producers, creation of direct links between rural producers and urban consumers, and promotion of community gardens and other forms of 'urban agriculture'" (Rocha and Aranha 2003).

While each of these programming streams addresses an important component of the food security question, it is the third stream that is worth focusing on for the purposes of this paper. As in Canada, sweeping agrarian reform in Brazil is beyond the regulatory power

of municipal governments; however, by taking a social justice approach to food security, "the government of Belo Horizonte has designed programs that not only attend to the needs of its citizens, but that have also affected small producers in surrounding village areas in a very positive way" (Rocha and Aranha 2003). Because healthy foods such as fruits and vegetables are usually available only in large supermarkets, access and affordability have become been key issues for low-income populations throughout Brazil. Additionally, the small- and medium-scale farmers who produce most of Brazil's fresh fruit and vegetables generally lack the resources to effectively market their crops. However, due to SMAB's food security policies and programs, Belo Horizonte is currently "the only major Brazilian city in which the commercialization of fresh fruit and vegetables by 'alternative stores' surpasses (by far) the commercialization done through supermarkets" (Rocha and Aranha 2003).

These policies have increased accessibility and affordability for low-income urban populations that have traditionally faced challenges in accessing nutritious foods; furthermore, the direct marketing allows small- and medium-scale farmers to see more profit than they would with an intermediary purchaser. Belo Horizonte's food security policies and programs currently have three foci: they target producer-consumer links, ensure institutional food purchases of local food, and provide education and information on the benefits of healthy diets, thereby boosting the demand for local produce (Rocha and Aranha 2003).

Since their inception these programs have had a strong impact on the nutrition and health of residents, while also benefiting rural dwellers by providing a source of income, at a cost of less than 2% of the municipal budget. With 20,000 meals served at public restaurants and 155,000 students served through school meal programs, the programs have been found to positively serve low-income or otherwise food insecure populations. The policies have similarly benefited rural dwellers, as food is procured from thirty-four rural producers in eight municipalities surrounding Belo Horizonte as part of a program to "help rural families to establish themselves in the countryside, halting rural-urban migration" (Rocha 2009). While demonstrably useful to the well-being of residents, the

initiative still faces some uncertainty as the programs are viewed as possibly expendable. While providing nutritious, inexpensive food, these programs also do little to address the extreme inequality in income among residents, which remains an overarching challenge with regards to food security (Rocha 2009).

While the social, economic and political contexts of British Columbia and Belo Horizonte differ widely, the Brazilian municipal food security policies reveal the important role that municipal governments can play in developing a just and sustainable food system. As BC municipalities of various sizes take increasingly strong interest in food security planning through the development of Food Policy Councils in Vancouver, Kamloops, Quesnel, Kaslo and in three other BC regions (Mendes 2006; People's Food Policy Project 2009). The City of Vancouver has also shown serious commitment to local food security work through discussions of developing the New City Market on City of Vancouver land (Nield 2010). Belo Horizonte remains an important example for British Columbian municipalities not simply for the policies it has developed, but also for the leadership role it has played facilitating connections between rural farmers and urban residents, one of five key priorities in the MAL's BC Agriculture Plan (BC MAL 2005) and a challenge identified in chapter 4 as a concern for producers.

Despite local governments' inability to address the broader concerns related to agrarian reform, many of the concerns raised by farmers and discussed in Chapter 4 can nonetheless be addressed, at least partially, by local government food policy. While obvious differences exist between Brazil and Canada, the lessons learned from Belo Horizonte can benefit municipal food security here in BC and across the country. Local initiatives, including municipal support of local, sustainable agriculture, provide another policy route for the shift from industrial food production to sustainable agriculture.

5.3 Making the Case for Independent Agriculture

The above examples are intended not to provide comprehensive solutions to the challenges we face in our food system, but instead to show that alternatives exist to our current food system, particularly at the production and distribution stages. Agricultural innovation at the small-scale can provide an important piece of the future food security puzzle, as it may be possible to increase yields while simultaneously providing strong ecological services through the process of farming. This would value both financial capital and natural capital involved in agricultural production. New distribution models, including strengthening the links between producers and consumers, can address concerns around equitable access to food for poor urban residents while simultaneously supporting the work of small and medium-scale producers in the surrounding countryside.

6. Summary and Conclusions

This thesis set out to assess a range of critiques about the modern, industrial food system in British Columbia and Canada. Because of the interconnected global nature of our food system, this has necessitated sometimes taking a more broad geographical scope than the BC food system alone. At the outset I posed four research questions on agricultural production in North America, Canada and British Columbia. This chapter will provide a summary response to each question, based on the above analysis and a series of policy responses to the many challenges identified to sustainable agricultural production in BC and Canada.

6.1 Discussion of Research Questions

What are the impacts of increased consolidation and industrialization in North American and Canadian agriculture?

Increased consolidation of North American and Canadian farms has had significant impacts economic, social and ecological impacts. In the 20th century, as agricultural production in North America moved from small family farms to more larger, consolidated, more technologically-dependent production, the food system was also consolidating. A parallel vertical integration of the food system has occurred, where a few corporations increasingly control multiple components of the food system, from the development of inputs to processing, transportation and marketing. While in Canada much of the actual agricultural production has remained with independent producers, they are nonetheless feeling significant economic pressures, partly due to pressure from vertically integrated corporations and partly from the erosion of mandatory marketing boards that allow them to remain economically competitive.

A decline in independent producers in the United States has led to a vertically integrated form of agricultural production that is also highly dependent on agricultural technologies. This has had negative social and ecological consequences. Rural employment declines as agricultural technology (particularly mechanization) becomes more prevalent. Yet the technologies improved have also been shown to have devastating ecological impacts,

including, but not limited to, water pollution, soil erosion, and contribution to greenhouse gases.

As Canadian agricultural producers continue to struggle to remain competitive, there may be increased pressure to move to a more American model of agricultural production, where farms are vertically integrated into the rest of the food system through corporate ownership. This would lead to the same social and ecological issues seen in the United States, while also limiting broader food choice. While a wide range of products would remain on shelves, choices about whether an item is organic or genetically modified would rest with the few corporations controlling production itself.

What types of impacts will climate change and peak oil have on food production globally and in BC?

Humanity is in a state of global overshoot, where we are currently drawing down our natural capital in order to maintain constant economic growth. Despite the apparent wealth created by this system, a relatively small proportion of the world's population base consumes most of the world's resources. Climate change and peak oil are symptoms of this global overshot, and each pose a significant threat to global food supply. However, the extent to which they will impact our food system in Canada and BC remains unclear. It is very likely that over the 21st century the global food system will be significantly impact by a changing climate, particularly in tropical regions of the planet. While some analysts remain optimistic about the possibilities for Canadian agriculture, the unpredictability of the climate and the cost of appropriate adaptation measures could negate any possible benefits from a changed climate. Adaptation will also become increasingly costly as oil becomes scarcer and more expensive, which is a likelihood we face in coming years, though debate exists over how much time remains before this becomes a significant pressure. Finally, production, processing and transportation costs will also increase, which makes our dependence on industrial technologies to grow and ship our food questionable.

What types of social, economic and ecological challenges are small-scale BC producers currently facing?

BC represents a unique situation in Canada for the number of small agricultural producers that provide a significant proportion of our food. In light of ecological problems posed by industrial agriculture, and the looming crises of climate change and peak oil, small producers remain important because they are generally more capable of and willing to use sustainable agricultural processes than their large-scale corporate counterparts. However, BC agricultural producers face their own socio-political, economic and ecological limitations that must be overcome if we are to adapt to the changes discussed above.

What are some examples of alternative models that can help provide policy solutions that will help BC transition toward a more sustainable, socially just food system?

Other parts of the globe are already in the midst of transitioning from an unsustainable food system to one acknowledges ecological limitations and the need for equitable food system alternatives. In Russia, for example, a huge proportion of the population is involved in some form of food production. Most of it is small-scale, intensive and yields large amounts of food with no fossil fuel inputs, limited technology and a relatively light workload. In Brazil, the city of Belo Horizonte has pioneered relationships between small-scale rural producers and urban consumers. By developing an innovative, municipal-led model of food distribution, Belo Horizonte has ensured the financial viability of small, local producers and made significant gains toward addressing food insecurity. While these examples have very different social, political and economic contexts, they nonetheless point the direction for how the food system can be transformed to meet both sustainability and social justice goals.

6.2 New Policy Directions

This thesis has identified a number of problems with the modern industrial agricultural system. These include (i) the erosion of the family farm (ii) socio-economic barriers to small farms (iii) the ecological impacts of industrial production (iv) peak oil's impact on food security and (v) climate change's impact on food security. Each of these issues is multi-faceted and requires the development of in-depth and evolving policy responses. It is beyond the scope of this thesis to provide a comprehensive set of policy directions that

completely overhauls the federal and provincial approach to agriculture (though I would argue this is necessary). Instead, my goal is simply to outline policies that can help address some of the most immediate needs for working toward a sustainable food system in Canada and BC.

Table 3: Policy Recommendations for Local, Provincial and Federal Governments

Policy Category	Policy Type	Outcome(s)	Concern(s) Address
Support and promote sustainable agriculture	Strengthen tax incentives by reducing income tax and property taxes to small and medium-scale farmers moving toward organic methods; provide small grants for education on organic and/or permaculture.	Increased financial viability of small, sustainable farms Increased use of organic techniques	i, ii, iii, iv, v
Support and promote sustainable agriculture	Provide resources (small grants) and education to allow water conservation; particularly in arid or semi-arid areas. All new construction in these areas should include cisterns. Programs to develop safe and healthy rainwater and greywater irrigation systems should be subsidized and promoted for small and medium-scale farms.	Strengthened conservation methods to ensure sustainability of a key agricultural input, water	iii, v
Support and promote sustainable agriculture	Increase taxes on fossil fuel agricultural inputs in order to subsidize shift to organic production.	Provide funds for programs to promote sustainable production	i, ii, iii, iv, v
Develop strategies to ensure long-term farm income stability	Increased federal and provincial support for single-desk marketing boards.	Strengthens institutions that help farmers receive adequate financial compensation for their labour	i, ii
Develop strategies to ensure long-term farm income stability	Provincial and federal regulatory regimes should support the development of decentralized processing that allows small and medium-scale producers to process and distribute their products close to home (e.g. mobile abattoirs).	Increases access to necessary infrastructure for isolated farmers Strengthens local food economy by encouraging independent processors	i, ii, iii

Policy Category	Policy Type	Outcome(s)	Concern(s) Address
Develop strategies to ensure long-term farm income stability	Provincial and federal governments need to provide alternative income solutions for small and medium-scale farmers. For example, encourage small amounts of dense multi -family housing on farms to provide long-term income and promote long-term agricultural uses of farmland (Growing Green 2004).	Provides long-term income security for farmers Peripheral benefits could include greater understanding of agriculture and increased participation in the food system by non-farmers	i, ii
Develop strategies to ensure long-term farm income stability	Provincial and federal governments should identify possible incentives for providing ecological services, such as wildlife habitat, green space, etc.	Mitigate negative impacts of agriculture on ecological systems Strengthened conservation methods	i, ii, iii, v
Develop strategies to ensure long-term farm income stability	All levels of government should also eliminate barriers to alternative land tenure models, such as farmland trusts, that attract investment to sustainable agricultural practices (Growing Green 2004).	Provides a range of land-use models for encouraging sustainable agriculture Eliminates some financial barriers for new farmers	i, ii, iii, iv, v
Develop comprehensive local policy mechanisms to support and strengthen local food systems	Local governments, at the municipal and regional district level, should develop and support community-based food council. These councils should aim to integrate issues of nutrition, health, environment and economics with regards to the food system and provide local leadership and expertise in developing and/or supporting sustainable agricultural systems (Growing Green 2004). Where Agricultural Advisory Committees (AACs) exist, the mandate of the committees should extend to broader food system issues *or* partnerships should be made between AACs and food policy councils.	Strengthen relationship between local government and local agricultural producers Encourage agricultural sustainability and equity within the food system Strengthen adaptive capacity of local government to address possible food crisis	i, ii, iii, iv, v

Policy Category	Policy Type	Outcome(s)	Concern(s) Address
Develop comprehensive local policy mechanisms to support and strengthen local food systems	BC municipalities and regional districts should develop and house comprehensive food security or food system initiatives through local planning departments. Planning departments would be responsible for help support local food security initiatives (such as farmers' markets), develop policy recommendations and provide technical expertise to local food policy councils. By providing a permanent 'home' for food security initiatives food system issues can be addressed systematically and comprehensively.	Strengthen relationship between local government and local agricultural producers Encourage agricultural sustainability and equity within the food system Strengthen adaptive capacity of local government to address possible food crisis	i, ii, iii, iv, v
Develop comprehensive local policy mechanisms to support and strengthen local food systems	Local government food security initiatives should actively engage in distribution of local food, adopting the Belo Horizonte model to their needs and conditions. Initiatives should favour local producers engaging in or working toward sustainable agricultural practices. By purchasing local produce, local governments can provide a stable market for local producers while providing healthy food alternatives to residents.	Strengthen relationship between local government and local agricultural producers Encourage agricultural sustainability and equity within the food system Strengthen adaptive capacity of local government to address possible food crisis	i, ii, iii, iv, v
Develop comprehensive local policy mechanisms to support and strengthen local food systems	The BC Government should support the work of local planning departments and food policy councils by providing funding, resources and information for the development of local initiatives mandate municipalities. Funding to regional health authorities and the Provincial Health Services Authority should be maintained and augmented to continue the work of the Community Food Action Initiative.[19]	Strengthen relationship between local government and local agricultural producers Encourage agricultural sustainability and equity within the food system Strengthen adaptive capacity of local government to address possible food crisis	i, ii, iii, iv, v

[19] More information on this program available at http://www.phsa.ca/HealthProfessionals/Population-Public-Health/Food-Security/default.htm

While this policy framework runs contrary to some of the stances taken by our federal and provincial governments, there is nonetheless some cause for optimism. Several municipal governments have already taken significant steps toward supporting and encouraging food production, and the Provincial Health Services Authority of BC has funded food security programming across BC. These policies represent important first steps in moving away from a food system on the edge of crisis, toward one that can adapt to the significant changes we are likely to see in the coming century.

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