W3 | Work in a Warming World

Working Paper # 2011-10

A Profile of the Greenhouse Industry in British Columbia and Clues to Climate Change

Luis L.M. Aguiar
Associate Professor
Department of Sociology
University of British Columbia, Canada
luis.aguiar@ubc.ca

Abstract

This paper profiles the greenhouse industry in British Columbia, and seeks out the issue of climate change in the same industry. It concludes that the industry is expanding and is an important economic contributor to the economy of the province. It is also an industry that employs a large number of foreign migrant workers, who like most other workers in the industry, are on temporary employment basis. This has consequences for workers (see Aguiar et al for a discussion 2011). Finally, on the basis of scant literature that speaks to climate change issues, I argue that climate change has yet to be forcibly articulated by the stakeholders in the industry and thus a significant gap exists in the literature. I add that only through interviews and case study analysis with stakeholders in the industry, will we begin to pull out and understand the issues that implicate climate change in the greenhouse industry.

Presented at the Work in a Warming World (W3) Researchers' Workshop:
"Greening Work in a Chilly Climate", Toronto, Canada, November, 2011

Acknowledgements

This study is part of the Work in a Warming World Project (W3), a SSHRC-CURA Research Programme

The author appreciates the financial support received for this project through a Social Sciences and Humanities Research Council Community-University Research Alliance (SSHRC-CURA) research grant. W3 is a five-year research project to address the challenge of climate change for Canadian employment and work carried out under the direction of Carla Lipsig-Mummé at York University.

Introduction[1]

This paper profiles the greenhouse industry in British Columbia, and seeks out the issue of climate change in the same industry. It concludes that the industry is expanding and is an important economic contributor to the economy of the province. It is also an industry that employs a large number of foreign migrant workers, who like most other workers in the industry, are on temporary employment basis. This has consequences for workers (see Aguiar et al for a discussion 2011). Finally, on the basis of scant literature that speaks to climate change issues, I argue that climate change has yet to be forcibly articulated by the stakeholders in the industry and thus a significant gap exists in the literature. I add that only through interviews and case study analysis with stakeholders in the industry, will we begin to pull out and understand the issues that implicate climate change in the greenhouse industry.

This paper is based on reviewing, examining, ascertaining and assessing the literature - academic, governmental, industry - on the industry in the Fraser Valley[2] where the large majority of greenhouse businesses operate. While there is a noticeable list of publications on a myriad of issues in the greenhouse industry in general, in contrast, little of significance exists on climate change and its implications for the industry and workers. Hence, the task of identifying the impact of climate change in greenhouses in BC has focused on flushing out clues and making assumptions from writings and discussions not especially focused on climate change. This has been a frustrating process of investigative research but one which I hope will be somewhat remedied by a second phase of research focusing on empirical investigations (interviews, for example) with stakeholders in the industry about the meaning, impact and implications and consequences of climate change.[3]

In this paper, historical and contemporary documents on the greenhouse industry in British Columbia are reviewed to describe the emergence and expansion of the industry in recent years. The discussion of the industry in British Columbia is placed within the agro-food sector of the Canadian economy, and the greenhouse industry in the country. I provide this background and information for comparative reasons so that one can view the industry within the Canadian economy more generally and the larger greenhouse industry in Canada. The greenhouse industry offers an excellent case to ascertain how or if agribusiness aims to mitigate the threat of climate hazards since temperature, moisture and growing seasons for producing crops can be artificially managed in greenhouses. To remain economically competitive, controlling production costs in the industry are dependent on access to sufficient water, low-cost energy for heating, a secure export

[1] I would like to thank Tina Marten for research help as well as patience and excellent ability to work under pressure. Brady Holroyd also did research work in preparation for this paper. This paper is supported by a small grant from the WWW research network.

[2] There is also greenhouse activity in the Okanagan Valley and Vancouver Island. However, these regions are quite small when compared to the operations in the Fraser Valley (see figure 1 on page 13 for more evidence of this).

[3] In a second phase of my research programme, I shall conduct empirical research on the industry regarding the implications of climate change for the industry and what initiatives are being taken to deal with it.

market and a low-wage labour supply. How the industry manages this and its impact more broadly is discussed in this paper though from limited literature sources.

The paper is organized in the following manner. First, I describe the agri-food sector in the economy and its relationship to the agricultural sector. Second, I profile the industry focusing on the size and shape of the greenhouse industry in Canada. Third, a more specific discussion and examination of the greenhouse industry in the Fraser Valley is outlined. Fourth, I describe the employment relations and strategies in the industry. Fifth, I glean from the existing literature allusions to the issue of climate change.

Agri-foods

Agri-food industries range from farming to food and beverage to retail food and foodservice. In 2006 this cluster of industries contributed $87.9 billion to Canada's GDP and employed 2.1 million workers, which represents 8% of the total workforce in the Canadian economy (Government of Canada 2008). Agriculture and agri-foods are increasingly global industries as Canada's share of the total world agriculture production has grown over the last 15 years (Choudry et al 2009). For instance, in 2007 Canada was the 4th largest exporter and 6th largest importer of agri-food products in the world (Government of Canada 2008). Table 1 (in the appendix) quantifies the export of Canadian agricultural products, aquaculture, and fish to the global market, and shows too that greenhouse vegetables are amongst the largest Canadian exports in terms of sales.

Some very large firms dominate agro-foods (Government of Canada 2008; McMichael 2007). And as entire industries globalize, a pattern of regionalization and regional clustering of industries is also emerging to better position a place/location, and its embedded industries, in the global marketplace (Okanagan Partnership 2009; Aguiar et al 2011). Some writers call this a new localism in the midst of globalizing forces and flows (Coaffe and Johnston 2005). This is the case, for example, of the Okanagan Valley as business people group the industries of wine, food and beverage into one cluster in order to muscle it into the global market place of wine and food tourism choices (Okanagan Partnership 2008, 2009).[4]

The impact of climate change on the agricultural sector is not only significant but comprehensive Olsen (2009). According to Olsen (2009) there are widespread costs of climate change for industry, employment relations and workers. There are structural changes to labour markets (Standing 2011; Milkman 2006) and changes in climate patterns transforming existing industries and destroying others (Olsen 2009). Weather sensitive sectors such as agriculture will be most heavily impacted by climate change (Olsen 2009). This means that agricultural techniques will need to change in order to adapt and succeed. As a result the low-paying agricultural sector will be even more unstable and volatile in the future (Olsen, 2009). To address these changes in global agriculture, Olsen believes that adaption and mitigation are crucial features of a new agricultural reality and that they need to be implemented "in compliance with the

[4] Similar processes are at work in the Niagara Region of Ontario (Jackson 1985).

principle of sustainable development" (Olson 2009: 29). By adaption he means measures ranging from changing types of crops to financial assistance for people who have lost their agricultural employment. Mitigation focuses on addressing climate change through the reduction of greenhouse gas emissions, which according to Olsen can only be successful by changing current farming methods. But change to agriculture has to be introduced in a socially responsible way of a "just transition" which will "manage [the] change process in a manner that is consistent with social justice and equity." He adds that it "is important to balance social, environmental and economic concerns in order to address the consequences of climate changes in a fair and equitable way" (Olsen 2009: 13). The idea of a just transition as equitable and fair is attractive and makes a lot of sense. Some of the issues he raises – weather – are not necessary as pressing in the greenhouse industry (since it is organized to bypass weather patterns and unpredictability) as they might be in other areas of agricultural activity. However, heating greenhouses is an issue of high energy cost and the consequences of the heating techniques themselves. But is just transition achievable in agriculture - in the greenhouse industry - in a sector embedded in neoliberalism? I will return to this question after highlighting the climate change aspects in the greenhouse industry alluded to in a scattering of writings.

As these economic processes are taking shape, Canadians are increasingly concerned with environmental degradation and climate change, and expect creative and sustainable solutions to these problems (Macleans 2011).[5] Many are pushing for eco-economies that are environmentally sound, even if the federal government wavers and dithers on how and when to create climate change legislation and policies in line with countries beyond the United States (Macdonald 2011). In practice Canadians demand local control, local produce by local production processes with shorter routes to market for distribution to mitigate pollution by reducing gas emissions. They believe that this can and should be accomplished while retaining jobs and a proper standard of living. This might not be feasible (Lipson 2011) though this kind of environmental ethical citizenship respects the land and the environment in an ecologically changing world. This trend is seen in the increase of organic farms, 1 in 6 farms in BC are now organic (Vancouver Sun 2007) and more farms are springing up in Census Metropolitan Areas (Statistics Canada 2006). Some Canadian provincial governments take these sentiments to heart by encouraging agriculture and other agri-food industries to practice environmentally sound businesses (Government of British Columbia 2009; Macdonald 2011). But these are government guidelines only and so the enforcement and policing of said practices are inconsistent if not suspect.

Canadian farmers too are reading the public opinion landscape and adopting best practices on how to conserve the soil, protect water quality and reduce greenhouse gas emissions. These are positive steps in addressing the challenges of climate change in the new ecological world order (Garner 2011; Harris 2011). Paul Harris says that "[c]limate

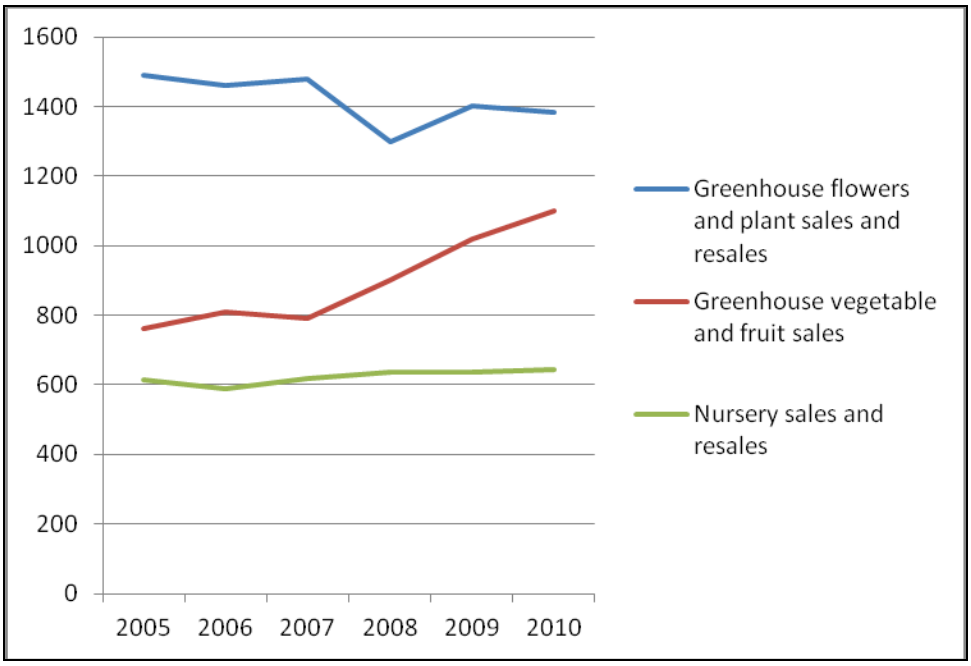
[5] According to a recent pool, 80% of Canadians (58% of Americans) believe in the science of climate change. 65% of Canadians (43% for Americans) also think that government has a role to play in climate change. "Twice as many Canadians as Americans are also willing to pay the price of a carbon tax" (Macleans 2011).

change is the greatest challenge facing humanity" (2011: ix). But these initiatives, practices, and policies (Macdonald 2011) are at the scale of the sector and industry. Often left out of the discussion is the scale of the workplace and the role agri-food workers can play in identifying and designing ways to better respond to climate change. There is no doubt that those at the frontlines of labour processes (workers) are best positioned to see ways to conserve; preserve while still engaged in economic activities in the midst of the pressures and opportunities of climate change. Anything less than this is a top-down directive, short-sighted and unsustainable by an un-engaged and un-involved workforce or supervisory staff. Moreover, an examination of the way in which the industry defines climate change is rarely highlighted, thus bypassing an understanding of how climate change is conceptualized and tackled. The latter is of course absolutely necessary since it orients the industry's patterns towards climate change and how to deal with it. So, an examination of the definition is crucial since it shapes patterns and relationships as well as conceptualizes the issues and defines and marks out ways to address them.

Profiling the Greenhouse Industry in Canada

The greenhouse industry is composed of three sectors (see chart 1): greenhouse vegetables growers – tomatoes, cucumbers, peppers, lettuce and herbs; the floriculturists which include cut flowers, flowering, potted, bedding and foliage plants; and finally, nursery growers involved in a range of trees, shrubs, perennials and vines.

Chart 1: Sales of Greenhouse and nursery products, Canada, 2005-2010



Source: Reproduced from Statistics Canada (2010), *Greenhouse, sod and nursery industries*, p. 5.
http://www.statcan.gc.ca/access_acces/alternative_alternatif.action?l=eng&loc=http://ww

w.statcan.gc.ca/pub/22-202-x/22-202-x2010000-eng.pdf&t=Greenhouse%20Sod%20and%20Nursery%20Industries (Accessed Nov. 1, 2011).

The greenhouse industry operates across the country with facilities in Alberta and the Maritimes. Most greenhouses are in Quebec, Ontario and British Columbia (see table 2; Government of Canada 2008) but the industry is expanding in all regions of the country, as can be seen in tables 2 and 3.

Table 2: Greenhouse area keeps expanding

Total area (m²)			
	1991	**2001**	**% Change**
Canada	**8,438,666**	**17,933,961**	**112.5**
British Columbia	1,787,225	4,552,771	154.7
Prairie Provinces	770,188	1,428,446	85.5
Ontario	3,803,941	8,969,298	135.8
Quebec	1,672,748	2,417,837	44.5
Atlantic Provinces	404,564	565,608	39.8

Source: Reproduced from Sparks and Irving. Statistics Canada. (2005). *What is growing under glass?* p. 64. http://www.statcan.gc.ca/access_acces/alternative_alternatif.action?l=eng&loc=pdf/4225298-eng.pdf (Accessed Nov. 1, 2011).

Table 3: Greenhouse sales rose across the country

$			
	1996	**2001**	**% Change**
Canada	**963,571,300**	**1,858,465,116**	**92.6**
British Columbia	246,343,000	437,302,666	76.5
Prairie Provinces	80,346,000	143,650,000	78.8
Ontario	445,422,000	1,000,326,000	124.6
Quebec	128,934,000	185,427,000	43.8
Atlantic Provinces	62,526,300	91,759,450	46.8

Source: Reproduced from Sparks and Irving. Statistics Canada. (2005). *What is growing under glass?* p. 66. http://www.statcan.gc.ca/access_acces/alternative_alternatif.action?l=eng&loc=pdf/4225298-eng.pdf (Accessed Nov. 1, 2011).

According to 2010 government statistics, the total greenhouse area in Canada was 22.9 million square meters. This is half a million square meters more than in 2009. Greenhouse products increased by 3% in the marketplace to reach about $2.5 billion in sales in 2010. Flowers and plant sales decreased by 1.8% while sales of vegetables increased by a significant margin of 10% (Statistics Canada 2011: 5). The industry is particularly prominent in Quebec, Ontario, and British Columbia "due to climatic and

energy advantages" and proximity to both domestic and US markets (Government of Canada 2008).

The greenhouse industry has a long history in Canada.[6] It is well over 100 years old here but much, much older elsewhere. In the 16th century glass houses, and later orangeries and conservatories, housed plants for the rich and wealthy. The first Canadian greenhouses were built during the first two decades of the 20th century in Leamington and Brampton, Ontario. At that time greenhouses were modeled after similar structures in England, which were small and free standing. By the 1940s greenhouses were well established in Leamington producing tobacco and vegetable seedlings in an area of 40 hectares. But in the 1950s, the Leamington greenhouse industry got a boost from an influx of Italian and German immigrants. The Italians focused on growing tomatoes and the German Mennonites cucumbers in greenhouses. By the 1960s, coal burning boilers which had been used to heat greenhouses were replaced by oil burning boilers. The energy crisis struck in 1973-1974. Consequently, heating methods were again updated and natural gas became the main supplier of heat. The late 1970s and early 1980s brought some major changes to the greenhouse industry. First, the North American Free Trade Agreement was signed and the sale of tomatoes previously restricted to Quebec became available more widely. Second, a technological breakthrough allowed for greenhouse plants to be grown in soil-less culture which provided opportunities for more strains of vegetables to be grown. Third, the Canadian greenhouse industry has historically benefitted from low exchange rate of the Canadian dollar to the American dollar and limited investment in greenhouse technology in the United States.

Table 4: 2002 World greenhouse vegetable production area (ha)*

Country	Production Area (ha)
Canada	876
United States	395
Netherlands	4,300
Mexico*	1,520
Spain*	70,000

*Note: When comparing relative size of operations between countries the different production technologies should be taken into account. For example, production in Mexico and Spain consists of a variety of production systems ranging from low to high technology greenhouses. Spain consist mostly of shade cloth production not glass production.

Source: Reproduced from British Columbia Ministry of Agriculture, Food and Fisheries. (November 2003). An Overview of the BC Greenhouse Vegetable Industry, p. 1. www.agf.gov.bc.ca/ghvegetable/publications/.../industry_profile.pdf (Accessed Nov. 3, 2011).

[6] The information contained in this entire paragraph is drawn from Papadopoulos and Gosselin 2007.

After a long period of continuous growth that started in 1990, greenhouse expansion hit a snag in 2007 as a consequence of the rising value of the Canadian dollar and higher labour and energy costs. The total greenhouse area under plastic and glass declined about 1% from a year earlier to approximately 20.9 million square meters in 2007 (Saha and Trant 2008: 14). In addition, two other factors impacted the growth of the Canadian greenhouse industry. They are natural gas and its rising cost, and increasing imports from Mexico which at times overwhelm the domestic market putting pressure on Canadian growers to adjust and respond (Papadopoulos and Gosselin 2007: 24). Nevertheless, the greenhouse vegetable industry in Canada remains an important part of the Agri-food sector (Papadopoulos and Gosselin 2007: 24). In the 1990s the industry went through a period of consolidation which mirrors the pattern in agriculture more generally of fewer but larger enterprises (Choudry et al 2009; Sparkes and Irving 2005: 63).

Greenhouse producers of flowers and plants accounted for two-thirds of total greenhouse sales. But for the first time since 1993, vegetable area, which was 10.7 million square meters, exceeded plant and flower area, which stood at 10.3 million square meters in 2007. Sales of flowers and plants increased by 1.5% in 2007 with Ontario growers accounting for 52% of all flowers and plants sold by Canadian growers. Greenhouse growers sold $806 million of vegetables in 2007, virtually unchanged from the previous year, with tomatoes accounting for 44% of the total vegetable sales. However, some producers switched production from tomatoes, with area planted falling by 3.7%, to peppers (+11.1%) and cucumbers (+3.6%). The total nursery area increased by 1.3% to 21,507 hectares in 2007, following two years of decline. Nursery sales increased by 5.5% to $630 million with sales to landscapers and garden centres accounting for 46% of total sales. The sod area increased by 1.8% to 23,862 hectares. The nursery and sod industries employed 15,485 persons in 2007, a 10.1% increase over the preceding year. Sales of nursery and sod operations reached $758 million in 2007, up by 5.6% from the previous year, with nursery operations accounting for most of the gain (Saha and Trant 2008: 14). The industry is highly mechanized and may become even more so as a growing number of US companies get into the greenhouse industry and existing ones expand (Government of Canada 2008). Of the estimated 869 hectares of greenhouse vegetable area in Canada, Ontario accounts for 530 hectares (Papadopoulos and Gosselin 2007: 24). The major areas of greenhouse vegetables in Ontario are in the southern region of Essex Country and near the town of Leamington (Papadopoulos and Gosselin 2007: 24). The town of Leamington has the highest concentration of greenhouse vegetables in all of North America, with a total of 480 total hectares. Canada has recently become a net exporter of tomatoes to the United States (Papadopoulos and Gosselin 2007: 24).

Technological change has spurned on the development of the greenhouse industry over the years. In the past 20 years technological advances such as soilless media, computerized climate control, and double-polyethylene greenhouse glass have improved greenhouse production with greater yields and better quality products (Papadopoulos and Gosselin 2007: 29). Recently glass covered greenhouses have been introduced because it has become more affordable and the pressure on farmers to extend their farming season year-round. But given the rise in energy cost to heat greenhouses, glass covered greenhouses “might prove short lived” (Papadopoulos and Gosselin 2007: 27). These improved methods and outputs have led to a great increase in the greenhouse vegetable

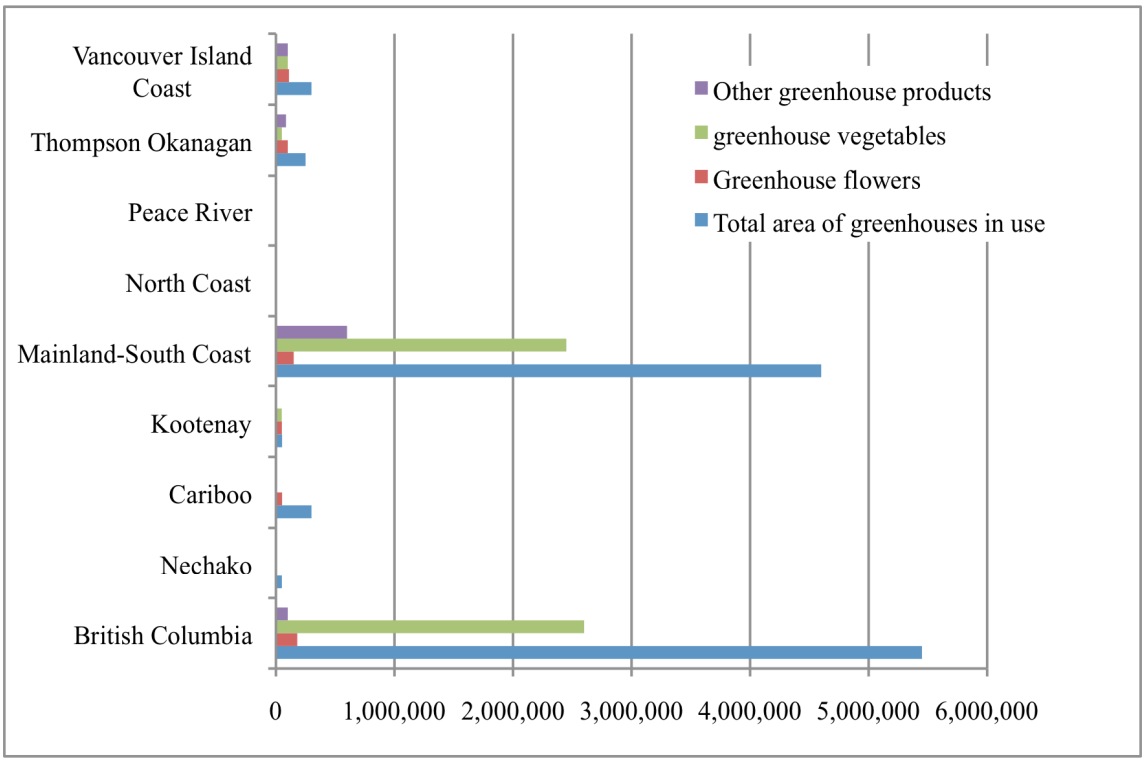
sector in Canada between 1988-2000. Modern forms of media, which no longer need soil to grow greenhouse plants, has resulted in larger yields, lower energy consumption and fewer chemical use (Papadopoulos and Gosselin 2007: 26). The future of the industry is in the growth of greenhouse plants without the use of chemical pesticides (Papadopoulos and Gosselin 2007: 26). This alone will increase demand in an expanding market for chemical-free greenhouse plants. New provincial regulations mean that many greenhouses have to adapt in order to ensure they are not polluting groundwater (Papadopoulos and Gosselin 2007: 26). This will mean the reduction of chemical use in the future and water will likely be reused or recirculated (Papadopoulos and Gosselin 2007: 26).

This being the scenario in the Canadian greenhouse industry, the following are important issues of concern. They are: (1) the high energy costs are a major worry for Canadian greenhouse growers as natural gas is an important and costly input in the industry (Papadopoulos and Gosselin 2007: 28); (2) there is also increased competition from growers in Mexico and the United States, both of which have the advantage of relatively inexpensive labour compared to Canadian growers (Papadopoulos and Gosselin 2007: 28); (3) an increasingly strong Canadian dollar relative to American and Mexican currency also puts Canadian growers at a disadvantage (Papadopoulos and Gosselin 2007: 28); (4) growers in the southern United States and Mexico also have an advantage in that year round growing is easier and more cost effective than in Canada (Papadopoulos and Gosselin 2007: 28); and (5) the lack of availability and high cost of labour in the industry (Aguiar et al 2011).

British Columbia's Greenhouse Industry

Agriculture and related activities in BC produced $2.3 billion in revenue and employee over 30,000 people in the province (Ference Weickert 2006: 5). The greenhouse industry in western Canada is primarily located in the Fraser Valley of BC with some low level activity in the Thompson/Okanagan region, the Cariboo and Vancouver Island. As figure 1 shows the Fraser Valley greenhouse industry significantly outstrips any other region in the province. It is also the case that (see table 5) these other provincial regions above together do not match the number of facilities or sales of the greenhouse operations in the Valley.

Figure 1: Total greenhouse production



Source: Reproduced from The British Columbia Agriculture in the Classroom Foundation. (2008). *Grow BC: A Guide to BC's Agriculture Resources*, p.19. www.aitc.ca/bc/uploads/growbc/1_intro.pdf

Table 5: 2004 Distribution of BC production areas (in square meters) by geographic region

Region	Long English Cucumber	Tomatoes-on-the-vine (TOV)	Beefsteak Tomato	Pepper	Lettuce	Total
District I (Lower Mainland)	241,679	764,786	352,750	815,999	13,328	2,188,542
District II (Vancouver Island)	28,705	200	3,500	5,955	500	38,860
District III (Interior)	27,654	0	49,588	6,200	0	83,442
Total	298,038	764,986	405,154	828,154	13,828	2,310,844

Source: Reproduced from British Columbia Ministry of Agriculture, Food and Fisheries. (November 2003). An Overview of the BC Greenhouse Vegetable Industry, p. 2.

www.agf.gov.bc.ca/ghvegetable/publications/.../industry_profile.pdf (Accessed Nov. 3, 2011).

British Columbia accounted for roughly 33% of greenhouse area in Canada in 2003 (Purdy 2005: 4). There are 42 greenhouses in BC employing over 3,200 workers (British Columbia Growers' Association [BCGA]– quick fact 2011). The types of vegetables grown are the following: more than 5 different types of tomatoes, sweet bell peppers, hot peppers, mini peppers, long English cucumbers, mini cucumbers and butter lettuce (BCGA - quick facts 2011). The distribution of vegetables produced is the following: 36% tomatoes; 12% long English cucumbers; 44% bell peppers and 8% of other. The average number of plants per acre is: 10,000 tomatoes, 6,000 cucumbers and 14,000 peppers (BCGA - quick facts 2011). The industry more than holds its own when compared to the industry in other locations in the country (see table 6).

Table 6: BC's top 25 agricultural and aquaculture commodity sales and national ranking

Ranking	Commodities	2010 BC Receipts ($'000)	2010 Canada Receipts ($'000)	BC share of national	BC ranking in national
1	Dairy	493,741	5,523,912	8.9	3
2	Farmed Salmon	394,200	598,974	65.8	1
3	Chickens	304,129	1,967,043	15.5	3
4	Floriculture	233,711	1,165,031	20.1	2
5	Nursery	171,242	499,974	34.3	2
6	Beef	223,708	6,161,325	3.6	6
7	Tomatoes (Greenhouse)	140,811	508,865	27.7	2
8	Eggs - Total	92,316	704,451	13.1	3
9	Peppers (Greenhouse)	87,427	270,123	32.4	2
10	Mushrooms	83,206	255,112	32.6	2
11	Blueberries	59,693	131,067	45.5	1
12	Turkeys	42,856	322,459	13.3	3
13	Cranberries	39,391	72,178	54.6	1
14	Potatoes	36,836	1,002,256	3.7	8
15	Sweet Cherries	36,495	39,486	92.4	1
16	Grapes	35,302	98,546	35.8	2
17	Hay & Clover	34,399	310,979	11.1	4
18	Apples	34,274	180,290	19.0	3
19	Hogs	30,122	3,360,757	0.9	6
20	Forest Products	15,346	105,127	14.6	3
21	Canola	13,342	5,596,565	0.2	5
22	Raspberries	12,795	24,402	52.4	1
23	Wheat	10,461	3,210,403	0.3	6
24	Lambs	8,531	133,347	6.4	5
25	Sod	7,874	136,883	5.8	4

Receipts and ranking are based on the most recent, 2010 farm receipts data, except aquaculture products for which data is currently only available to 2009.

Note: In 2010, from the list of British Columbia's top 25 agricultural sales, the province led the nation in farm receipts from the production of farmed salmon, blueberries, cranberries, sweet cherries, and raspberries. The province ranked second to Ontario in farm receipts for floriculture, nursery products, greenhouse tomatoes, greenhouse peppers, mushrooms, and grapes.

Source: Reproduced from British Columbia Ministry of Agriculture, Food and Fisheries (June 2011). *Fast Stats 2010. Agriculture, Aquaculture and Food*, p. 22. www.agf.gov.bc.ca/publicat/stats/FastStats2010_R2.pdf (Accessed Nov. 3, 2011).

British Columbia also enjoys trade advantages with the United States due to its proximity to the border and the tariffs that have steadily declined since 1989 (Purdy 2005: 4). In 2008 the BC greenhouse, nursery and floriculture production employs about 8,300 workers; "36% of the agriculture industry's GDP originates in the greenhouse, nursery and floriculture industry" (Ministry of Regional Economic and Skills Development and BC Stats 2010). The "Greenhouse area grew to 57.3 million square feet, a 14.7% increase since 2001. The province holds close to a quarter (24.0%) of the total greenhouse area in Canada" (BC Statistics 2006). The greenhouse industry itself in the province provides 8,000 jobs with farm gate sales of half a billion dollars which translates into $1.5 billion other BC business activities (BCAC 2007). With these numbers, the greenhouse industry comprises 21 percent of the total value of BC agriculture yet uses only 0.01% of the province's land under the Agriculture Land Reserve Act (BCAC 2007).

Labour and Employment in the industry

Labour costs as part of the total expenses of the greenhouse industry were $604 million in 2010. This represented 28.5% of all expenses (Statistics Canada 2010: 5). In greenhouses specializing in producing flowers and plants, the labour costs represented 31.1% of all expenses. Between 2009-2010, labour costs increased by 3.5% while the total number of workers decreased by 3.7% (Statistics Canada 2010: 5). It appears that more is being done with fewer workers. In this case the intensification of work in greenhouses compensates for the reduced number of workers while still increasing profit. In 2010 the total number of workers in greenhouses producing flowers and plants was 22,160 (Stats Can 2010: 6). It is perhaps this high cost of labour more than any other issue that explains the agricultural sector, including the greenhouse industry in BC and across the country turning towards hiring foreign migrant workers.

Historically, the agricultural sector (including greenhouses) in the province employed immigrant labour (e.g. Indo-Canadians) who arrived in Canada either as independent immigrants or as part of the family class status clause in the immigration act and re-unification of family members (Trumper and Wong 2007; Lanthier and Wong 2002). But since the 1980s the government narrowed the eligibility criteria for potential immigrants, promoted business migrants more aggressively instead (Ley 2010) and reduced services to immigrants or downloaded them onto strapped community organizations or immigrants themselves (Aguiar et al 2011; Choudry et al 2009; Simmons 1999; Abu-Laban and Gabriel 2002). Consequently fewer manual labourers are available to take on agricultural work. At the same time, the neoliberal model has extended into the industry as competition increased and the rate of profit dropped. Industry and government turned to an aggressive employment recruitment strategy whereby workers were brought into the country for a short period of time – length of the growing season – and with few rights and even less claims on a dismantling welfare state (Aguiar et al 2011; Trumper and Wong 2010; Choudry et al 2009; Thomas 2010). The agricultural sector, including the

greenhouse industry, is largely governed by a temporary and seasonal employment relationship (see tables 7, 8). And this has consequences for farm workers' well being, accommodations, state of mind and militancy (or not) in the workplace (Aguiar et al 2011; Fairey et al 2008). Both the agricultural sector and the greenhouse industry employ increasingly foreign temporary workers through two labour mobility programs (the Caribbean and Mexican Seasonal Agricultural Programs) and the Temporary Foreign Worker Program (Aguiar, et al 2011). The combination of factors, climate uncertainty and costs of production, raises the question as to whether agro-corporations will continue to rely on foreign workers and/or modify labour practices to offset the risk of climate uncertainty. In other words, will agribusiness mitigate environmental risks by shifting the cost on to the agricultural labour force, experienced as social risk through low-wages, unsafe and polluting work, and labour intensification? The defense mechanisms to prevent this from happening are few, to say the least. "Union coverage is not common in agriculture. About 5% of workers have union coverage, compared to 31% of all workers in the economy. Forty percent of the workforce is female. Although this is lower than the average for all industries (47%), agriculture is the only goods-producing industry in which women make up such a large percentage of the total workforce. Unemployment rates for farm workers are higher than average. Between 1990 and 2008, the average jobless rate in this industry was 10.9%, compared to 7.8% for the province as a whole" (Ministry of Regional Economic and Skills Development and BC Stats (2010: 9).[7]

[7] The UFWC has the Workers Alliance doing good work, and there is also the Justicia for Migrant Workers organization.

Table 7: Labour - Total greenhouse employees

	Total Greenhouse Employees 2009			Total Greenhouse Employees 2010		
	Seasonal[1]	**Permanent[2]**	**Total**	**Seasonal[1]**	**Permanent[2]**	**Total**
			Number			
Newfound-land and Labrador	265r	55r	320 r	270	60	330
Prince Edward Island	130E	15	145	85	15	100
Nova Scotia	490	F	700	460	160	620
New Brunswick	590	F	1,000	515	335	850
Quebec	4,350 r	2,000 r	6,350r	4,250	1,930	6,180
Ontario	9,630r	7,090r	16,720r	9,385	7,405	16,790
Manitoba	910r	230r	1,140r	865	240	1,105
Saskatchewan	900r	175	1,075 r	865	175	1,040
Alberta	2,465r	980r	3,445r	2,140	1,150E	3,290
British Columbia	3,520r	3,060r	6,580 r	3,610	3,000	6,610
Canada	**23,250**r	**14,225**r	**37,475**r	**22,445**	**14,470**	**36,915**

1. Seasonal employees who worked less than 8 months during the year.
2. Permanent employees who worked more than 8 months during the year.
Note(s): Includes mixed operations (vegetables, flowers and plants).

Source: Reproduced from Statistics Canada. (2010). *Greenhouse, sod and nursery industries*, p. 25. http://www.statcan.gc.ca/access_acces/alternative_alternatif.action?l=eng&loc=http://www.statcan.gc.ca/pub/22-202-x/22-202-x2010000-eng.pdf&t=Greenhouse%20Sod%20and%20Nursery%20Industries (Accessed Nov. 1, 2011).

Table 8: Labour – Specialized greenhouse operations

	Greenhouse vegetable employees			Greenhouse flower and plant employees		
	Seasonal[1]	**Permanent[2]**	**Total**	**Seasonal[1]**	**Permanent[2]**	**Total**
			Number			
2009						
Atlantic provinces	100	40E	140	1,140r	590E	1,730r
Quebec	590 r	725 r	1,315r	2,790r	970r	3,760r
Ontario	2,940r	2,670r	5,610r	5,725r	3,950r	9,675r
Prairie provinces	260	370	630	3,790	980	4,770
British Columbia	1,090r	935	2,025	1,585r	1,490r	3,075r
Canada	**4,980r**	**4,740r**	**9,720r**	**15,030**	**7,980r**	**23,010r**
2010						
Atlantic provinces	125	55	180	1,030	490	1,520
Quebec	695	855	1,550	2,820	850	3,670
Ontario	2,970	2,580	5,550	5,415	4,090	9,505
Prairie provinces	265	360	625	3,160	1,160 E	4,320
British Columbia	1,305	970	2,275	1,590	1,555	3,145
Canada	**5,360**	**4,820**	**10,180**	**14,015**	**8,145**	**22,160**

1. Seasonal employees who worked less than 8 months during the year.
2. Permanent employees who worked more than 8 months during the year.
Note(s): Excluding mixed operations (vegetables, flowers and plants).

Source: Reproduced from Statistics Canada. (2010). *Greenhouse, sod and nursery industries*, p. 25. http://www.statcan.gc.ca/access_acces/alternative_alternatif.action?l=eng&loc=http://www.statcan.gc.ca/pub/22-202-x/22-202-x2010000-eng.pdf&t=Greenhouse%20Sod%20and%20Nursery%20Industries (Accessed Nov. 1, 2011).

The Greenhouse Industry and Climate Change

There is an abundance of research in the Canadian agricultural sector, including some on the greenhouse industry (Basok 2002; Aguiar et al 2011; Preibisch 2007; Thomas 2010). But in this growing literature little seems to be directed towards investigating and examining climate change and its impact and consequences for the industry in BC or elsewhere. As a result, it is difficult to include a discussion of this issue that is thorough and insightful. A second phase of this project will investigate climate change through interviews with key stakeholders in the industry. We hope to get a much better perspective on climate change through this route. In the meantime and in the remainder of this paper, I will outline some of the climate change related issues mentioned in passing in the literature on the greenhouse industry in BC.

Weather has always been fundamental to the reason d'etre of the greenhouse industry. After all, the industry was erected on the idea that since weather is unpredictable and can significantly affect both the quantity and quality of the crop, building a self-contained environment where weather is "controlled" and the growth of crops predictable, made a lot of sense. So I ask "to what extent is climate change responsible for the emergence of the greenhouse industry?" It turns out that the erection of the greenhouse industry has little to do with environmental concerns (e.g. gas emissions from field production) and almost exclusively with the extension of the growing season particularly in geographical areas where soil, planting and the growth of crops were deemed to require protection from the "elements". It is also by extending the workday that exploitation intensifies and surplus value increases (Marx 1986). The rise and growth of the industry is not related to the weather, climate change or the environment. Instead, AuYeung (1996) and Purdy (2005) list three reasons for the emergence and expansion of the industry. They are: (1) greenhouses produce up to 10 times the yield of field production (AuYeung 1996) and this is a significant return on investment and labour production; (2) greenhouse produce is of much better quality than field-grown vegetables as a result of the controlled environment under which they are grown. Tomatoes, for example, ripen on vine stem rather than in a box in a truck on the way to the market. This makes greenhouse produce more valuable and fresher than field vegetables (Purdy 2005) and it also means that the industry needs to be close to the market; and (3) the demand from the US market helped grow the Canadian greenhouse industry especially through reduced export tariffs and technological advantages Canadian greenhouses have over greenhouses in the United States (Purdy, 2005).

It is said that with regards to crop management, physiology, and greenhouse environment, modern forms of media which no longer need soil to grow greenhouse plants have resulted in larger yields, lower energy consumption and fewer chemicals use (Papadopoulos and Gosselin 2007: 26). New provincial regulations mean that many greenhouses have to adapt in order to ensure they are not polluting groundwater (Papadopoulos and Gosselin 2007: 26). This likely means that chemical use will have to be reduced in the future, and water may have to be reused or recirculated within the facilities. The future of the industry is in the growth of greenhouse plants without the use of chemical pesticides (Papadopoulos and Gosselin 2007: 26). This alone will increase demand as there will be an expanding market for chemical-free greenhouse plants. It is

premature to fully flush out the climate change issue in the greenhouse industry given that little has been found on the industry in our survey. However, a few key terms and ideas can be found in a small number of publications. As I mentioned above, these ideas need to be supplemented with interviews in order to clearly identify the climate change challenges to those in the industry. Natural gas heats greenhouses but rising costs in the purchase of this commodity is a worrying concern for employers in the industry. There are alternatives to natural gas – coal, wood pellets, wood waste, wind power, solar and geothermal energy. However, the concomitant need for CO_2 in vegetable greenhouses means that another source of CO_2 must be provided, unless natural gas boilers are retained. For existing facilities this is feasible, but for new operations, liquid CO_2, CO_2 generators or the adoption of technology to extract CO2 from exhaust gases is necessary (Zebeetnoff, 2006: 39). The BC Greenhouse Growers' Association (BCGGA) writes: "Our greenhouse producers use state-of-the-art technology – computers monitor every aspect of indoor growing such as light, temperature, humidity, ventilation, water, nutrients, heat and carbon dioxide". It continues: "highly efficient boilers heat the greenhouses and produce carbon dioxide, which is essential to healthy plant growth. Heat produced by the boilers on hot summer days is often stored for evening use, while the carbon dioxide is used during the daylight hours". And: "Boilers have the best available emission controls to keep the plants and the environment healthy. Water used in the hydroponic systems is recycled and nutrient levels are constantly monitored and adjusted. Rainwater is often collected, filtered and used to irrigate the plants" (BCGGA n.d.). Table 9 reveals that the greenhouse industry consumes more energy - as a percentage of revenue – than any other farm business type on the list. We are at the point of analysis where statements from the industry are claims yet to be fully examined. To do so requires broader sources of data on the industry and climate change.

Table 9: Average energy expense for BC farms in 2003

Farm Type	Operating revenue (dollars)	Fuel	Utilities[1]	Total energy (dollars)	Percent of operating revenue
Oilseed and Grain Farming	103,076	$5,826	$1,630	7,456	7%
Potato	432,170	$12,654	$7,917	20,571	5%
Other Vegetable and Melon farming[2]	190,599	$5,716	$5,090	10,806	6%
Fruit and Tree Nut Farming	149,546	$3,381	$2,314	5,695	4%
Greenhouse, nursery and Floriculture	834,366	$7,509	$63,588	71,097	9%
Other Crop Farming	90,455	$5,020	$2,402	7,422	8%
Beef Cattle Ranching[3]	111,940	$6,161	$2,172	8,333	7%
Dairy cattle and Milk	625,175	$11,906	$11,497	23,403	4%
Hog and Pig	660,292	$6,580	$17,739	24,319	4%
Poultry and Eggs	711,197	$4,132	$22,051	26,183	4%
All Farms	**248,176**	**5,485**	**$8,758**	**14,243**	**6%**

1. All utilities including natural gas heating, electricity and telephone
2. Excluding potatoes
3. Includes feedlots

Source: Reproduced from British Columbia Ministry of Agriculture, Food and Fisheries. (2006*). Fast Stats 2006. Agriculture, Aquaculture and Food*, p. 9. www.agf.gov.bc.ca/publicat/stats/FastStats2010_R2.pdf (Accessed Nov. 3, 2011).

In addition, the British Columbia Agricultural Council (BCAC) identifies five environmental responsible farming practices, some of which touch on climate change:

- Greenhouse farmers provide "environmental stewardship through voluntary environmental farm planning";
- The BCAC speaks of conserving land and water;

- The conservation of nutrients through the "Re-using water protects natural watercourses and reduces the reliance on fossil-fuel based fertilizers";
- The conservation of energy is pursued by "greenhouse operators utiliz[ing] heat storage systems, efficient boilers, thermal blankets and fossil fuel alternatives" and;
- "Responsible emission – Biomass systems include state-of-the-art emission controls that meet or better provincial and federal standards" (BCAC 2007).

These practices and the extent to which they guide and are followed and respected by/in the industry are difficult to access without primary research activity. Still, we can raise some questions which can be dealt with in a second phase of this research. So, in the lineup of environmental practices stated above, the discourses of responsibility and voluntarism are prominent. Both of these concepts are standards in the neoliberal economic model of downloading onto the industry standards, responsibilities and enforcement that the Keynesian state previously undertook and policed with significant sanctions as deterrent. In the context of neoliberalism in BC, policy and policing of industry is largely done through a "peer pressure" rationale whereby members of a business group know best the issues and so it should be left to the industry itself to meet out the consequences of non-compliance (transgressors) with guidelines (Aguiar 2004; Ratner and Carroll 2005). So, important questions need to be raised with regards to the ideas of responsibility and voluntarism. To whom is the BCAC responsible to? Is it to the industry only? What does voluntary environmental farm planning mean? What input is there from outside the industry (from NGOs, trade unions, government) to pressure for change or push for a faster pace to change in industry practices that may not be as environmentally sound as expressed above? How and by whom will climate change in the industry become more central? A glimpse to possible answers to these questions is offered below.

The BC Environmental Farming Plan Programme (EFPP) was launched in 2003 for the purpose of "complement[ing] and enhance[ing] the current environment and stewardship practices of producers". The programme partners the Agriculture and agri-food Canada (AAFC), the BC Ministry of Agriculture and lands (BCMAL) and the BC agriculture research and development corporations (ARDcorp) (Ministry of Agriculture (n.d.). The BC ARDcorp writes that participant farmers can identify their farm's environmental strengths, recognize environmental risk and "take advantage" of tools and techniques available to manage those risks. The Farm Plan developed by the farmer is confidential and "you [the farmer] are under no obligation" to implement the plan (BC Agricultural Research and Development Corp. n.d.). A separate document says that the audit and farm plan developed by the farmer "is not a legal requirement" and voluntary since it is only drawn up to help farmers "identify areas where environmental improvements should occur on a farm or ranch" (Ministry of Agriculture, November 2010: 1). The Sustainable Agriculture Management Branch "identifies and promotes agriculture and food production systems that are environmentally sustainable by incorporating the best management practices to protect air, soil and water quality. The Branch also monitors environmental indicators to anticipate and respond to future threats to the environment from current agriculture practices and threats to agriculture from environmental and climate changes". What are these threats and how are they identified and by whom is not

said but "The Sustainable Agriculture Management Branch is divided into **four key program areas**; strengthening farming, resource management, environmental programs and initiatives, and waste management/emergency preparedness" (emphasis in original; Ministry of Agriculture n.d).

There are generalities and no specific tools to ensure that climate change or the environment is addressed on an ongoing basis. What exists is basic with a hands-off approach designed by the neoliberal government of BC as an executor of the industry. Because the farm plan is voluntary, not a legal requirement and with no government compulsion to impose implementation of specific changes, there are too no penalties or sanctions for non-compliance since the producer is under no legal obligation to devise one up or follow it with steps to implementation. All of this is voluntarism is left to the common sense of the producer to do the right thing (Aguiar 2004). But more often than not this means doing right from a business stand point. It also means that downloading the management of the industry, the government practices a laisser-faire approach. While this may be a good thing for business operators, it dismisses community interest in the way greenhouses do their business and distances broader stakeholders from engagement with the industry. How is "just transition" (Olsen 2009) to be implemented with voluntarism and responsible farming being the guiding principles of neoliberal farming and under the direction of greenhouse farmers themselves?

Nonetheless, environmental concerns about the industry's practices have been raised: (1) environmentalists believe greenhouses are harmful to natural habitats and wildlife (AuYeung 1996: 15); (2) greenhouse neighbours and some residents believe greenhouses are ugly and ruin the countryside appearance of other farms (AuYeung 1996: 15); (3) emissions from greenhouse heating are also a worry for environmentalists (AuYeung 1996: 15); and (4) greenhouse use requires more water to be delivered by human means, which is seen as an increasingly problem due to the already insufficient amount of yearly rainfall in the Fraser Valley (AuYeung 1996: 16) and an even greater issue in the dry dessert-like conditions of the Okanagan and farms therein (Wagner and White 2008).

Conclusion

The greenhouse industry is a significant economic contributor to the economy of this country. It is not only in terms of its sales but also in terms of employment and produce. There are important publications on agriculture and the greenhouse industry across Canada. However, little of this literature centres on the issue and impact of climate change. I have tried to profile the industry and pull out from the scant literature on climate change and greenhouses what I consider to be important factors to consider in a discussion of climate change. I'm disadvantaged in this paper by the lack of sources and the reliance on industry documents and no fieldwork investigation with other stakeholders in the industry. Some of the issues I identify as important to investigate in a case study include – boilers; how to heat greenhouses and the gases associated with this; the issue of glass greenhouses and a few others. There is an environmental critique of greenhouses and I have summarized this above.

What needs to be done next is a case study of climate change and greenhouses through interviews with key players associated with the industry. Such a project will not only allow me to understand climate change and its implications for the industry but also begin to assemble primary sources on greenhouses and climate change. In addition to identifying the climate change issues more clearly, issues such as who in the industry is raising this issue and how do they propose to go about changing them is an important consideration in research of this kind. How will issues be addressed when the state seems to indicate that it plays a hands-off approach to the agriculture industry in the province of British Columbia? Given this practice by the state, how will change be implemented and by whom? Further, the issue of risk (Arnoldi 2009) is often mentioned in the literature and industry and so this concept and how it operates and is used in the industry needs proper treatment and evaluation.

These are just some of the questions that remain unanswered in this paper and need original empirical investigation. My hope is that the second phase of this project will undertake this task.

Appendix

Table 1: Exports – All Countries

Exports of agriculture, aquaculture, fish and food products to all countries ($'000 CDN)				
	BC		**Canada**	
	2009	**2010**	**2009**	**2010**
Horses	4,420	14,221	42,411	54,691
Cattle and calves	66,730	58,391	1,121,858	1,128,490
Live poultry	871	953	354,468	388,897
Hogs	2,232	2,531	41,502	37,213
Other live animals	514	522	68,608	55,218
Beef	3,963	5,199	1,271,545	1,432,403
Pork	128,102	56,935	2,462,497	2,654,927
Poultry	31,242	30,487	334,429	333,712
Other meat	7,420	4,640	147,146	125,505
Animal fats	80,405	76,466	192,444	212,734
Other animal products	7,508	10,505	248,111	277,626
Fruits & nuts	254,868	237,436	640,171	610,505
Field vegetables	71,081	85,577	3,794,440	3,625,450
Greenhouse vegetables	140,067	132,244	544,163	595,376
Vegetable seeds for sowing	3,013	3,033	126,323	92.434
Other seeds for sowing	2,667	2,177	192,489	171,568
Dairy and edible products	12,788	15,686	248,443	239,299
Eggs	832	2,286	45,239	56,273
Cereals	18,260	20,951	7,004,154	5,624,732
Milled cereals & milling products	25,580	26,084	870,483	682,179
Cereal preparations	173,716	176,647	2,360,803	2,393,406
Oilseeds	14,458	20,852	4,925,587	5,185,927
Vegetable oil & oilcakes*	22,096	22,211	2,2041241	3,014,297
Alfalfa, fodder & animal feeds	75,682	84,278	558,207	562,425
Coffee, tea & spices	32,252	34,372	342,208	420,645
Fruit & vegetable juice	39,428	46,654	142,420	134,682
Water	41,891	30,658	123,199	122,491
Other non-alcoholic beverages	3,577	4,915	41,465	37,648
Beer & cider	16,510	14,482	231,156	236,614
Wine	3,069	5,514	19,217	27,978
Distilled spirits	141	1,432	375,981	394,102
Sugar & sugar confectionary	15,605	19,715	807,494	801,471
Sauces, soups & food preparations	98,217	127,296	1,185,981	1,158,308
Cocoa & cocoa preparations	26,939	37,517	774,837	950,564
Industrial by-products and residues	20,082	23,118	97,512	109,822
Raw hides & skins**	3,137	4,824	181,796	291,756
Furskins	44,406	22,427	291,581	409,242
Plants, bulbs & flowers	56,266	57,128	296,884	302,240
Other plant products	8,610	6,443	296,599	340,863
Other agriculture products	5,171	4,341	169,478	169,465
Aquaculture products	354,256	346,039	533,124	555,688
Processed fish & seafood products***	521,134	604,119	3,070,687	3,307,621
Other fish & seafood products	7,071	5,931	20,663,	23,873
Total exports	**2,446,276**	**2,487,227**	**38,802,046**	**39,350,368**

Source: CATSNET Analytics, Statistics Canada (August 2011).

* B.C. data for Vegetable Oil and Oilcakes has been revised from $53.2 to $22.1 million in 2009 and from $264.2 to $22.2 million to account for an apparent discrepancy of canola oil/oilcakes that is under investigation by Statistics Canada.
** B.C. data for Raw Hides & Skins has been revised from $61.5 to $4.8 million in 2010 to account for an apparent discrepancy of raw bovine skins that is under investigation by Statistics Canada.
*** Export data for processed fish products in the 2011 Fast Stats include those products categorized in the HS codes as 'fresh' and 'live.' The Fisheries Act requires that fish go through processing facilities, which may only include sorting and grading, and so live fish are thus 'processed'.

Source: Reproduced from the Ministry of Agriculture, Food and Fisheries (June 2011). *Fast Stats 2010. Agriculture, Aquaculture and Food*, p. 21. www.agf.gov.bc.ca/publicat/stats/FastStats2010_R2.pdf. (Accessed Nov. 3, 2011).

References

Abu-Laban, Yasmeen and Christina Gabriel. 2002. *Selling Diversity*. Peterborough, ON: Broadview Press.

Aguiar, Luis LM. 2004. "Resisting Neoliberalism in Vancouver: An Uphill Struggle for Cleaners." *Social Justice* 31, 3: 105-129.

Aguiar, Luis LM, Tomic, Patricia, and Trumper, Ricardo. 2011. Mexican migrant agricultural workers and accommodations in farms in the Okanagan Valley, British Columbia. Working Paper no.11-04. Vancouver: Metropolis British Columbia.

Arnoldi, Jakob. 2009. *Risk: An Introduction*. Cambridge: Polity.

AuYeung, Louise. 1996. "Comparative Advantage of Greenhouses in Delta." UBC Library.

Basok, Tanya. 2002. Tortillas and Tomatoes: Transmigrant Mexican Harvesters in Canada. Kingston: McGill-Queen's.

Bregha, Francois. 2011. "Time to Get Serious about the Strategic Environmental Assessment of Federal Government Policies and Plans." In Christopher Stoney and G. Bruce Doern (eds.), *How Ottawa Spends*, 2011-2012. Montreal: McGill/Queen's University Press, pp144-162.

British Columbia Agriculture Council. 2007. "The Facts about British Columbia's Greenhouse Agriculture." Kelowna: BC Agriculture Council.

BC Agricultural Research and Development Corp. (n.d.) Canada – BC Environmental Farm Plan Program. http://www.bcefp.ca/index.php?page_id=14 (Accessed Nov. 4, 2011).

BC Agriculture in the Classroom. 2008. 'Grow BC': A Guide to BC's Agriculture Resources. Abbotsford, BC.

BC Ministry of Agriculture, Food and Fisheries Industry Competitiveness Branch. 2003. Factsheet: An Overview of the BC Greenhouse Vegetable Industry. Abbotsford, BC.

BC Greenhouse Growers; Association (n.d.) Agricultural Advantage: BC's Greenhouse Vegetables.

----. "Quick Facts." http://www.bcgreenhouse.ca/quick_facts.htm accessed 2 November 2011.

BC Ministry of Agriculture and Lands. (n.d.) B.C.'s Food Self-Reliance. Can B.C.'s Farmers feed our Growing Population? Victoria: Ministry of Agriculture and Lands.

BC Ministry of Regional Economic and Skills Development and BC Stats. 2010. *A Guide to BC Economy and Labour Market*; http://www.guidetobceconomy.org/major_industries/agriculture.htm (Accessed Nov. 4, 2011).

BC Ministry of Agriculture. (n.d). *Environmental Farm Planning*. http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/index.htm (Accessed Nov. 4, 2011).

BC Ministry of Agriculture. 2010. "Introduction." In *Reference Guide. The Canada – British Columbia Environmental Farm Plan Program*. P1. November (Accessed online Nov. 4, 2011).

BC Ministry of Agriculture. (n.d.) *Sustainable Agriculture Management Branch*. http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/index.htm (Accessed Nov. 4, 2011).

BC Ministry of Agriculture, Food and Fisheries. 2004. "Commodity: Greenhouse." Victoria: BC Government.

Choudry, Aziz, Jill Hanley, Steve Jordan, Eric Shragge and Martha Stiegman. 2009. *Fight Back: Workplace Justice for Immigrants*. Halifax: Fernwood.

Coafee, Jon and L. Johnston. 2005 "New Localism and the management of regeneration." *International Journal of Public Sector Management,* 18(2), 108-113.

Fairey, David, Christina Hanson, Glen MacInnes, Arlene Tigar McLaren, Gerardo Otero, Kerry Preibisch and Mark Thompson. 2008. *Cultivating Farmworker Rights: Ending the Exploitation of Immigrant and Migrant Farmworkers in BC*. Vancouver: Canadian Centre for Policy Alternatives.

Ference Weicker and Company. Focus on the Future. Developing the Agri-Food Industry in BC. Final Report. 3 March 2006.

Garner, Robert. 2011. *Environmental Politics: The Age of Climate Change*. New York: Palgrave Macmillan.

Government of British Columbia. 2009. Ministry of Agriculture and Lands. Service Plan Summary 2008/2009-2010/11. Victoria: Ministry of Agriculture and Lands.

Government of British Columbia. "Commodity Greenhouse." Ministry of Agriculture and Food and Fisheries, 2004.

Government of Canada. Agriculture and Agri-Food Canada. Overview of the Canadian Agriculture and Agri-Food system 2008. www4.agr.gc.ca/AAFC/display-afficher.do?id=1228246364385&lang=eng (Accessed July 6, 2009).

Harris, Paul G. 2011. *Ethics and Global Environmental Policy*. Cheltenham, UK: Edward Elgar.

Jackson, J. 1985. "British Columbia and Ontario: Some Comparisons in the Provincial Approach to Safeguarding Agricultural Land." *Ontario Geography*, 26.

Lanthier, M. Lloyd Wong. 2002. "Ethnic Agricultural Labour in the Okanagan Valley: 1880s to 1960s." Royal BC Museum Living Landscapes Series. Victoria: Royal British Columbia Museum. http://livinglandscapes.bc.ca/thomp-ok/ethnic-agri/index.html (Accessed 11 November 2011).

Ley, David. 2010. *Millionaire Migrants*. Malden, MA: Wiley-Blackwell.

Lipson, Daniel N. 2011. "Is the Great Recession only the Beginning? Economic Contraction in a Age of Fossil Fuel Depletion and Ecological Limits to Growth." *New Political Science* 33(4): 555-575.

Macdonald, Douglas. 2011. "Harper Energy and Climate Change policy: Failing to Address the Key Challenges." In Christopher Stoney and G. Bruce Doern (eds.) *How Ottawa Spends*, 2011-2012. Montreal: McGill/Queen's University Press, pp127-143.

Macleans. "Canadians more concerned than American about Climate Policy". http://www.macleans.ca/general/canadians-more-concerned-than-americans-about-climate-policy/ (Accessed 11 November 2011).

Marx, Karl. 1986. *Capital*. Volume 1. Moscow: Progress Publishers.

Milkman, Ruth. 2006. *L.A. Story: Immigrant Workers and the Future of the U.S. Labor Movement*. New York: Russell Sage Foundation.

McMichael, Philip. 2007. "Globalization and the Agrarian World." In George Ritzer (ed.) *The Blackwell Companion to Globalization*. Malden, MA: Blackwell, 216-238.

Okanagan Partnership. 2009. "New Rules for Regional Performance." www.okanaganpartnership.ca (Accessed 6 July 2009).

---- 2008. Okanagan Tourism Labour Study 2008. Kelowna, British Columbia.

Olsen, Lene. 2009. "The Employment Effects of Climate Change and Climate Change Responses: A Role for International Labour Standards?" GURN, Global Union Research Network, Discussion Paper No. 12.

Papadopoulos, T. and A. Gosselin. 2007." Greenhouse Vegetable Production in Canada." *Chronica Horticulture*, 47, 3. http://www.actahort.org.ezproxy.library.ubc.ca/chronica/pdf/ch4703.pdf?referer=www.clickfind.com.au#page=23

Preibisch, Kerry. 2007. "Globalizing Work, Globalizing Citizenship: Community-Migrant Worker Alliance in Southern Ontario." In Luin Goldring and Sailaja Krishnamurti (eds.) *Organizing the Transnational: Labour, Politics, and Social Change*. Vancouver: UBC Press, pp. 97-114.

Purdy, Jake. 2005. "High-Tech Vegetables: Canada's Booming Greenhouse Vegetable Industry." Statistics Canada. Catalogue no. 21-004-XIE. Ottawa: Government of Canada.

Ratner, Robert and William Carroll. 2005. *Challenges and Perils of Social Democracy in Neoliberal Times*. Halifax, NS: Fernwood.

Saha, Bishnu and Michael Trant. 2008. "Canadian agriculture in 2007: better farm prices and incomes as world demand for food increases". Statistics Canada, Government of Canada. October.

Simmons, Allan. 1999. "Economic Integration and Designer Immigrants" Canadian Policy in the 1990s. In Max Castro (ed), *Free Markets, Open Societies, Closed Borders?* Miami: North-South Center Press, University of Miami, 53-69.

Sparkes, Ainsley and Elizabeth Irving. n.d. "What's Growing under Glass." Statistics Canada. Catalogue no. 96=325-XPB. Ottawa: Government of Canada.

Standing, Guy. 2011. *The Precariat: The New Dangerous Class*. New York: Bloomsbury Academic.

Statistics Canada. 2010. *Greenhouse, Sod and Nursery Industries*. Catalogue no. 22-202-X. Ottawa: Government of Canada.

Statistics Canada. 2006. *Farming in Canada's CMA's*. http://www.statcan.gc.ca/ca-a2006/articles/cacma-rarmr-eng.htm (Accessed Nov. 3, 2011).

Trumper, Ricardo and Lloyd Wong. 2007. "Canada's Guest Workers: Racialized, gendered and Flexible." In Sean Hier and B. Singh Bolaria (eds.) *Race and Racism in 21st Century Canada: Continuity, Complexity and Change*. Peterborough: Broadview Press, pp. 151-170.

Vancouver Sun. 2007. "Farming booms in BC." 17 May 2007. http://www.canada.com/vancouversun/news/story.html?id=85a783a5-9ebb-4665-ad4d-1fd3ce0ca289

Wagner, John and Kasondra. 2008. "Water and Development in the Okanagan Valley of British Columbia". Paper presented at the "Regional Studies and the Rural-urban Dynamic: an interdisciplinary perspective." Centre for Regional Studies Conference St. Francis Xavier University. Antigonish, Nova Scotia.

Zbeetnoff Agro-Environmental Consulting. *The North American Greenhouse Vegetable Industry*. 13 August 2006.