

B.C.'s Food Self-Reliance

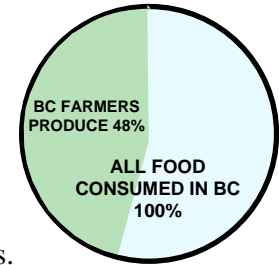
Can B.C.'s Farmers Feed Our Growing Population ?



EXECUTIVE SUMMARY

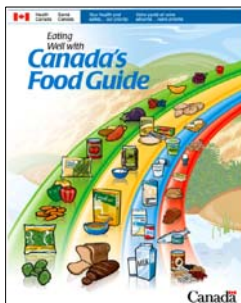
The question of food self-reliance is often raised at sustainable development planning exercises. Previous estimates of food self-reliance in B.C. have compared product flows at the wholesale level. The use of wholesale prices provides some insight into the planner's question, but it does not connect the food productive capacity to the resources in the province or the community that planners can influence. A more useful tool for sustainable development planners would be a link between food self-reliance and the resources they influence - land and water.

The general approach of this study is to estimate the food self-reliance in B.C. at the primary production level, and to use this information to examine the impacts of a change in eating habits and a change in population on the level of food self-reliance in B.C.



Production and consumption information from 2001 is used in the calculations. It is estimated that B.C. farmers produce 48% of **all** foods consumed in B.C. and produce 56% of foods consumed that can be economically grown in B.C. The following table shows the level of self-reliance for the different food groups.

Food Group	B.C. Consumption Million Kg's	B.C. Production Million Kg's	% Self-Reliant
Dairy	1080	617	57%
Meat & Alternatives ¹	467	298	64%
Vegetables - Grown in B.C.	764	331	43%
Fruit - Grown in B.C.	172	273	159%
Grain for Food	315	43	14%
Total - Grown in B.C.	2798	1562	56%
Fruit - Not Grown in B.C.	310		
Vegetables- Not Grown in B.C.	1		
Sugar	136		
Total - B.C.	3245	1562	48%



When comparing current production to recommended consumption by *Canada's Food Guide to Healthy Eating*², B.C.'s food self-reliance drops to 34%. This is primarily because a healthy diet recommends a higher level of consumption of fruits and vegetables over actual 2001 consumption levels and fruits and vegetables is a food group in which B.C. is not self-reliant³.

¹ Alternatives includes pulses and nuts.

² Published by Health Canada. http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/index_e.html

³ While B.C. produces and exports a lot of fruit, B.C. still imports 3 times as much fruit as it exports.

Given the production technology available today, over half a hectare of farmland (0.524 ha) is needed to produce the food for one person for one year. This is roughly equivalent to 6 city lots. In order to produce a healthy diet for British Columbians, farmers need 2.15 million hectares of food producing land of which 10% (215,000 hectares) needs to be irrigated. In 2005 the Ministry of Agriculture and Lands estimated that approximately 189,000 hectares of farmland had access to irrigation.

To produce a healthy diet for the projected B.C. population in 2025, farmers will need to have 2.78 million hectares in production of which 281,000 will need access to irrigation. This means that to produce a healthy diet for British Columbians in 2025, given existing production technology, the farmland with access to irrigation will need to increase by 92,000 hectares or 49% over 2005 levels.

To maintain the current level of self-reliance through to the year 2025, farmers will need to increase production by 30% over 2001 levels. The increased production will be concentrated on the land that has access to irrigation – land that is typically near the urban centers.



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1. Background

The question of food self sufficiency is often raised at sustainable development planning exercises. The focus of food self sufficiency can be on a local area, a region or a province. The basic question behind the discussion of food self sufficiency can be framed as follows:

‘What portion of the food consumed in a (local area, region, province) is produced in that area and, as the population grows, what is needed to maintain or expand the portion of food produced in that area? ‘

The term food self sufficiency can include an element of affordability. The question from the sustainable planning perspective is more related to capacity – what is our capacity to produce our own food? The term self-reliance has been used to better fit the sustainable development planning perspective.

The population in British Columbia is projected to grow by 30% from 2001 to 2025⁴. Over the same period the demand for food will experience a similar 30% increase. Some sustainable development planners are beginning to include food in sustainability considerations. The question they ask is ‘Can our farmers meet the increase in demand for food - can they continue to feed us?’

The answer to this question is complex. It depends on consumer demands, the level of production technology in the farming community, the availability of farmland and water for irrigation, the impact of global markets (imports and exports) and others. The ability to analyze the question is further challenged by the lack of complete and accurate data for all these elements.

Two previous studies on food self-reliance in British Columbia (Markham and Riemann)⁵ looked primarily at the flow of products at the wholesale level. The advantage of this approach is that it captures food at the same point in the marketing channel and data for the main marketing channels is readily available. The disadvantages are:

- it captures a point in time, which can be influenced by large annual swings in production,
- it needs to account for imports and exports which adds an additional level of inaccuracy to the estimates,
- it does not consider yearling cattle produced in B.C. and shipped out of province for finishing,
- it does not account well for farm direct marketed products, and
- it does not consider the forage and grain inputs used for livestock production.

The use of wholesale value provides some insight into the planner’s question, but it does not connect the food productive capacity to the resources in the province or the community where the planners are working. A more useful tool for sustainable development planners would be a link between food self-reliance and the resources the planners influence - land and water.

⁴ Lower Mainland Employment Study; Coriolis Consulting, 1999

⁵ Reference on page 8.

2. Introduction

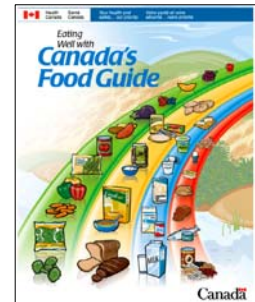
The goal of this study is to develop a methodology to estimate food self-reliance using farm gate production rather than wholesale value. This approach will provide a link between the food productive capacity of the province and the land base, water resources, and changing food needs of the population.

The results of the study will help answer the following questions:

- what is our current level of food self-reliance?
- what impact will a growing population have on our food self-reliance?
- what impact will changing food consumption patterns have on our food self-reliance?

The approach used in this study is different from previous studies in that it:

- examines primary production (farm gate) rather than wholesale value.
- uses land in production and average yields to estimate production rather than the value of production that reaches the wholesale level.
- estimates the amount of land needed for self-reliance now and in the future.
- compares production to both actual consumption and the recommended consumption according to *Canada's Food Guide to Healthy Eating*.



Using farm gate production eliminates some of the challenges of the wholesale value approach. Specifically it:



- eliminates the need to address imports and exports as they net out (on a weight basis) in the production approach,
- captures all the direct market sales by capturing the production,
- includes the weight of all yearling calf production in B.C., and
- includes forage and grain production required for livestock feed.

An added benefit of using farm gate production as compared to wholesale value is that food production can be connected to farmland. Connecting food production to the land base provides the opportunity to explore the impacts of changes in population and production technology on the land needs for the future, and enables policy makers to better understand the impacts of land use policy decisions on B.C.'s food self-reliance.

The methodology can examine the impact of production technology (through improved yields), however, that analysis is beyond the scope of this study. For the analysis and discussion of the impacts of population growth in this study, it is assumed that food production technology is held constant.

3. General Approach

The general approach of this study is to estimate the food self-reliance in B.C. at the primary production level. An important consideration was to structure the analysis so that it could be repeated in the future. The majority of the data used is obtained from Statistics Canada. For this report the 2001 census data was used. Specific references are included in the bibliography in Section 9.

A number of data challenges were identified in Sections One and Two. They include: accounting for cross border food product flows, estimating production, accounting for forage and feed grain for livestock production, and considering the responsiveness of food production to market pressures. The following paragraphs outline how these challenges were addressed.



Cross-Border Food Product Flows

Commodities that are produced in B.C. for trade create a challenge when analysing food self-reliance at the wholesale level. For example B.C. produces high quality greenhouse tomatoes that are sold to the U.S while at the same time it imports less expensive field tomatoes from California. Estimating farm gate production directly eliminates the need to use imports and exports to estimate what portion of the wholesale value is produced in B.C. The wholesale value approach will also tend to overestimate B.C. production on a weight basis as B.C. tends to export high value tomatoes and import lower value tomatoes⁶.

B.C. yearling cattle are often sold to Alberta where they are fed for a period of time before slaughter. Some of this meat is shipped back to B.C. for consumption. In this study, for calves finished out of province, the calf to yearling stage of production in B.C. was added to B.C. production.



Estimating Production

Estimating production poses the challenge of capturing the growing farm direct market sales, and adjusting for unusually large or small crops in the study year. These two challenges are addressed by estimating the area of production and multiplying by an average or standard yield. The advantage of this approach is that it smoothes production spikes, includes production for farm direct sales, and better estimates B.C.'s production 'capacity'. It may, however, overestimate production in some areas where farm management practices vary significantly, i.e. forage and pasture management on small acreages.

⁶ This means that \$10 of exports may relate to 5 lbs of tomatoes exported while \$10 of imports may relate to 10 lbs of tomatoes imported.

Inputs for Livestock Production

Forage and grain inputs are required to feed livestock in order to produce meat, eggs and dairy products. B.C.'s ability to meet the feed requirements of these animals is included in the analysis of food self-reliance.

Other Considerations

Agricultural land produces more than just food, and food also comes from B.C.'s ocean and rivers. The focus of this study was to connect the land based food production to the land. The food self-reliance was estimated with and without seafood, and the non-food agriculture production is also estimated.

The soils and climate in B.C. can support the production of many food products, however, some popular foods such as bananas, some vegetables and citrus fruit cannot be produced economically in B.C. Self-reliance is calculated for foods produced in B.C. and also when including foods not normally produced in the province.



4. Other Studies

There has been limited work done on addressing the issue of food self-reliance in a large regional area. Much of the work examining the term 'food self sufficiency' involves providing food to disadvantaged groups, looking at very small regional production areas and including consideration for food prices.

Two studies have looked at food self-reliance in B.C., Markham (1982)⁷ and Riemann (1987)⁸. Van Bers (1991)⁹ did a future estimate of self-reliance in 5 provinces for the year 2031 and Warnock (1982)¹⁰ did a less rigorous estimated of self-reliance in 1982. The results are summarized in Table 1:

⁷ Markham, Roe. *Supply and Demand Balance in the B.C. Food Sector: A Statistical Analysis*. ARDSA Project No. 271304. (1982).

⁸ Riemann, Walter. *The B.C. Food Balance*. B.C. Ministry of Agriculture and Fisheries (1987).

⁹ Van Bers, C. 1991. *Sustainable Agriculture in Canada : a scenario of the future*. M.A. Thesis, University of Waterloo, ON

¹⁰ Unpublished report – no longer available

Table 1 Summary of Self-Reliance Estimates of Previous Studies in BC							
	1975	1978	1980	1982	19841	1985	2031
Markham	51%	53%	56%				
Warnock				47%			
Reimann					69%	73%	
Van Bers							< 50%

Both Markham and Riemann looked at foods produced in B.C. and used the wholesale value of production and consumption. Looking at wholesale value (\$) as compared to quantity (weight) will tend to increase the estimated level of self-reliance because:



- B.C. tends to produce more high value to weight products (e.g. more meats as compared to vegetables), and
- B.C. produces more high value products within commodity groups. For example B.C. produces more greenhouse vegetables relative to field vegetables, and more fluid milk relative to industrial milk.

The main difference between Markham's and Riemann's results are their estimates for red meats – Markham estimated roughly 25% self-reliance while Riemann estimated 49%. The different estimates are primarily the result of Riemann considering the B.C. contribution of yearling cattle to the Alberta feedlots, while Markham did not.

Warnock concluded that BC was 47% self-reliant and that to maintain this level would require a 40-60% increase in production to the year 2000. The complete paper was not available¹¹.

Van Bers (1991) conducted a futuristic estimate of food self-reliance for 5 Canadian provinces in 2031. The study looked at food groups but excluded meat and animal feed. The estimates for B.C. are shown below in Table 2:

Table 2 Van Bers - Self-Reliance Estimates for B.C. - 2031	
Vegetables	23%
Fruit	25%
Grain – Food	86%
Grain – Feed	16%
Forage / Hay	69%

Van Bers estimate suggests a total level of self-reliance at or below the other studies.

¹¹ The author was contacted and indicated it was not a very rigorous study

5. Results

This section summarizes the results of the two approaches taken by this report to estimate food self-reliance in B.C.

Table 3 summarizes the results for the comparison of actual consumption to B.C. production in 2001. Table 4 is a summary of the comparison of consumption as recommended by the *Canada' Food Guide to Healthy Eating* to B.C. production in 2001.

Production Compared to Actual Consumption

The estimates in Table 3 separate the foods that are grown in B.C. from the foods that are not grown in B.C. Fish is considered separately. Feed and forage needs for the production of meat and dairy are estimated. Both are noted at the bottom of Table 3 for interest.

These results are consistent with previous studies and with the prevailing perceptions in industry and government agencies¹². Self-reliance estimates on a commodity basis are presented in the detailed data sheets in Section 9.

Table 3 Summary of Comparison of Food consumed in B.C. and Food Produced in B.C.			
Food Group	B.C. Consumption Million Kg's	B.C Production Million Kg's	% Self-Reliant
Dairy	1080	617	57%
Meat and Alternatives	467	298	64%
Vegetables - Grown in B.C.	764	331	43%
Fruit - Grown in B.C.	172	273	159%
Grain for Food	315	43	14%
Total - Grown in B.C.	2798	1562	56%
Fruit - Not Grown in B.C.	310		
Vegetables- Not Grown in B.C.	1		
Sugar	136		
Total - B.C.	3245	1562	48%
Fish	381	179	471%
Forage and Feed Grain	3538	3795	107%

If fish is added to the land based production it would raise the self-reliance on products produced in B.C. from 56% to 61% and total food from 48% to 53%

¹² Anecdotal evidence from the author's interactions with other agencies indicates there is a general perception that B.C. is roughly 50% self-reliant in food production.

While the level of feed and forage production meets the input needs of the industry on a weight basis, it does not meet the needs on a grain/forage ratio basis. Currently the horse industry uses over 200 million kilograms¹³ of forage per year that is not part of food production and the poultry, dairy and hog sectors use more grain than is produced in B.C.



The dairy sector has recently received a higher relative allocation of the national milk quota so it is likely that self-reliance in dairy food products will be higher in 2006.¹⁴

Production Compared to Consumption Based on *Canada's Food Guide to Healthy Eating*

Canada's Food Guide to Healthy Eating makes recommendations in 'servings per day'. For a comparison to actual production, production had to be converted to servings per day. Table 4 shows the actual and recommended consumption in servings per day and compares them to actual production in servings per day.

Table 4 Summary of Food Guide Recommendations with Food Produced in B.C.						
Food Group	Daily Servings (consumption)			Home Grown Production Million Kg's	Home Grown Production as % of Recommended (Food Guide)	Home Grown Production as % of Consumption
	Food Guide	Actual	Actual as % of Food Guide			
Dairy	2.87	2.23	78%	1.28	45%	57%
Meat & Alternatives	2.25	2.37	105%	1.49	66%	64%
Fruits	3.75	.75	20%	1.47	39%	159%
Imports¹⁵		1.18	31%			
Vegetables	3.75	2.91	78%	1.6	41%	43%
Grain - Food	8.5	9.8	115%	1.3	15%	14%
Total	21.12			7.14	34%	
Fish	.25	.25	100%	1.09	436%	

Canada's Food Guide to Healthy Eating recommends higher consumption of dairy, fruit and vegetables and lower consumption of meat and grains than is currently consumed in B.C.

Imported fruits have been included (tan colour) in the comparison of British Columbians' actual consumption to the recommended consumption. Combining the locally grown fruit (20%) and import fruit (31%) totals actual consumption of 51% of the Food Guide recommendation for fruits.

When looking at the foods we produce, a shift to the recommended healthy diet by all British Columbians would reduce our food self-reliance to 34%.

¹³ Ministry of Agriculture Fisheries and Food, *B.C Horse Industry in the 1990's*. 2000

¹⁴ This may reduce self-reliance in forage production, however, it will depend on how and where the increased production occurs.

¹⁵ This may reduce self-reliance in forage production, however, it will depend on how and where the increased production occurs.

6. Discussion and Implications

6.1 Trends in Food Self-Reliance

While it is difficult to summarize across studies that use different methodologies, the various analysis of B.C.'s food self-reliance indicate B.C. is at best maintaining past levels of self-reliance. Previous studies, most focusing on products B.C. farmers produce, have estimated self-reliance between 47% and 73%. The estimate of 56% in this study is in that range.

Self-reliance in supply managed¹⁶ commodities was limited in the 1980's and 1990's by a national policy of allocating quota on historical population distributions. B.C. producers have recently been given additional quota based on actual population so the level of self-reliance will likely increase in these sectors in 2006 – particularly in dairy.

The population of B.C. has increased 82% from 1971 to 2001. Agriculture (including non-food) output, adjusted for inflation, has gone up 114 %¹⁷ over the same period. Farm output¹⁸ has been able to grow along with an expanding population to meet market demand. How long B.C. farmers can continue to meet this growing demand for food is uncertain.

6.2 Land Needs for Self-Reliance

The methodology used in this study connects the food production to the land base. This provides the opportunity to estimate the land needed to produce food for British Columbians today and in the future.



Table 5 is a summary of the land needed to produce a healthy diet for one person. It is important to recognize that some foods can only be economically produced on land that is irrigated¹⁹. Land that needs to be irrigated is noted in green and includes fruit, vegetable and dairy production.

¹⁶ Production of dairy and poultry products in B.C. are regulated under the Natural Products Marketing Act. The Act limits imports and allocates production (supply) in B.C.

¹⁷ Statistics Canada Census of Agriculture adjusted by the CPI for food.

¹⁸ Farm output includes non-food agriculture such as floriculture and nursery that have shown very high growth over this period.

¹⁹ Farmland can be very broadly divided into land that does not have access to additional water (dry land farming) and land that has access to water for irrigation. Many crops, particularly fruits and vegetables need supplemental water to be economically grown in most of B.C.

Table 5 Hectares Needed to Produce a Healthy Diet for One Person					
	Servings /day	Raw Weight/day	Raw Weight/Year	Yield/Ha/yr²⁰	Hectares Needed (Irrigated)
Dairy	2.87	718 g	262 L	13,000 L	.020
				Grain	.048
Meat	2.5	188 g	68.6 kg		.394
				Range ²¹	
Grains	8.5	140 g	51.1 kg	1,750 kg	.029
Vegetables	3.75	225 g	82.1 kg	6.600 kg	.0177
Fruit	3.75	319 g	116 kg	9,600 kg	.0152
Total					.471
					.053

Combining the 0.471 ha of non-irrigated land with the 0.053 ha of irrigated land adds up to just over one half a hectare(0.524ha) of producing agriculture land is needed to produce a healthy diet for one person for one year. 10% of the land needs to have access to irrigation. In 2001, British Columbians needed 2.15 million hectares of food producing land to meet their food needs. 217,000 hectares of that land needed to be in the fruit, vegetable and dairy producing areas and have access to irrigation. By 2025, with similar production technology, British Columbians will need 2.78 million hectares of food producing land, of which 281,000 hectares would need access to irrigation, to meet their food needs. In 2005 the Ministry of Agriculture and Lands estimated that approximately 189,000 hectares of farmland in B.C. had access to irrigation.



In 2001 farmers in the fruit, vegetable and dairy producing areas reported irrigating 88,000 hectares - approximately 40% of what is needed for self-reliance. Interestingly, the estimated level of self-reliance in the sectors that need irrigation, dairy, fruit and vegetables, was 45%, 39% and 41% respectively – close to the proportion of reported hectares under irrigation²².



6.3 Pressure on Agriculture Land

The study indicates that as population grows and the demand for food grows, major pressure on agriculture land will likely come in the form of:

- the need for more irrigated land in the fruit, vegetable and dairy producing areas, and
- the need for more broadly applied pasture/forage management practices.

²⁰ Farmland can be very broadly divided into land that does not have access to additional water (dry land farming) and land that has access to water for irrigation. Many crops, particularly fruits and vegetables need supplemental water to be economically grown in most of B.C.

²¹ Farmland can be very broadly divided into land that does not have access to additional water (dry land farming) and land that has access to water for irrigation. Many crops, particularly fruits and vegetables need supplemental water to be economically grown in most of B.C.

²² Some irrigated land is for forage production for beef operations and in a few small areas fruits and vegetables can be grown without irrigation

The largest self-reliant shortfall in B.C. is in fruit and vegetable production. To be economically viable, fruit and vegetable production in B.C. needs irrigation. In 2001 farmers located in the main vegetable, fruit and dairy producing regions reported irrigating approximately 40% of the land needed for food self-reliance.

If prices for imported fruits and vegetables begin to rise, there will be significant pressure to bring more irrigated farmland into production to meet local demand.

The estimate for animal feed and forage self-reliance is based on the assumption that all census farms are using good pasture management techniques - achieving average production levels of 75% of those achieved in forage trials. This is not always the case. To continue to achieve self-reliance in animal feed and forage production the management of pasture land, particularly on small parcels around the urban centers, will need to be improved.

6.4 Regional Considerations

Agriculture production in B.C. is regionalized. For example, grains and oilseeds are produced primarily in the north, beef ranching occurs mainly in the Interior, the majority of tree fruits are produced in the Okanagan, dairy is concentrated in the Fraser Valley and north Okanagan, and the major production area for small fruits and vegetables is in the Fraser Valley. These regional differences are primarily driven by climate and soil type. Regional production differences need to be considered when evaluating farmland needed to meet the food needs in B.C. For example for B.C. to expand small fruit and vegetable production it will need access to more farmland with irrigation in the Fraser Valley or Vancouver Island. If B.C. needs to expand tree fruit production it will need access to more farmland (with access to irrigation) in the Okanagan.



6.5 Production from Dry Land Compared to Irrigated Land

The table below further illustrates, in very general terms, the difference in production potential between dry land and irrigated land²³.

	<u>Land Base</u>		<u>Sales</u>	
	('000ha)	%	(\$million)	%
Farmed Land	2,587		2,224	
Dry Land Production	2,476	96%	1,328	60%
Irrigated Land Production	111	4%	896	40%

Commodities that normally use irrigation make up only 4% of the producing land while accounting for 40% of the farm gate receipts.

²³ Irrigated land from Census of Ag 2001. Irrigated land sales included field vegetable, all fruits, grapes, nursery and dairy. Indoor agriculture (poultry, hog, mushroom, greenhouse) that also needs access to water was not included. It appears that the methodology is effective as a broad indicator of the need for irrigation for food production.

6.6 Role of Greenhouses in Food Production

Greenhouse production technology is very efficient at producing certain food crops. For a specific commodity, greenhouse production on a square meter basis can be 20 times higher than field crop production. Currently only 3 major vegetable crops are produced in greenhouses - tomatoes, peppers and cucumbers and the products produced in greenhouses tend to be at the 'premium' end of the price and quality spectrum. Greenhouse production currently meets 48% of tomato consumption, 150% of pepper consumption and 75% of cucumber consumption in B.C.



The limited number of food crops that can be economically grown in greenhouses in B.C. suggests that both greenhouse and field crop production are needed to meet the quantity and diversity of food needs in B.C.



6.7 Non-Food Production on Farmland

In 2001 the non-food sectors used 150,000 hectares of farmland to produce agriculture products. The sod, floriculture and much of the nursery production need access to irrigation.

Commodity	Hectares in Production
Nursery	42,077
Sod	837
Christmas Trees	6,018
Floriculture	3,000
Horses	100,000
Total	151,932

Floriculture greenhouse farms are averaged at 4 hectares in 2001²⁴ and the horse estimate is from the 1998 Horse Industry Survey.

Land in the Okanagan, Fraser Valley and Vancouver Island is capable of producing a wide range of food products, but the actual use of farmland is market driven. If the demand for food increases and production of specific food crops becomes more profitable for food production than non-food production, the land currently used for non-food production may shift from non-food to food crops.

²⁴ The number of floriculture producers was used with an estimate of 4 ha per farm.

7. Data Challenges and Future Considerations

A number of data challenges arose when doing this study. The author chose to use readily available sources so the study could be duplicated in the future. The more significant challenges were in estimating consumption statistics and estimating production yields.

Consumption Statistics

Consumption statistics are currently available on a national basis only. There are differences in food preferences between provinces that may affect the estimated food consumption on a provincial basis. Due to the ethnic make-up of B.C.'s population, certain foods are in higher or lower demand than in other provinces and may differ from the national reported amount. This affects the quality of consumption data for non-staple commodities, such as Chinese cabbage, mushrooms and goat meat.

Yield Estimates

The information used for the average yield estimates are not all from the same source. The method used was to first take the most reliable yield estimate provided by Crop Insurance²⁵, and then to use Ministry of Agriculture and Lands (MAL) planning budgets²⁶ to fill in the blanks. "Crop Insurance" estimates are assumed to be more accurate (updated) as the entity is paying out money based on these estimates. MAL planning budgets are considered a reliable source as the tool is designed by Ministry specialists to help planning initiatives for B.C. farmers. The issue is that some of the stated average yields are from older sources. Therefore, it is uncertain how reliable these estimates are given recent technology changes in the industry. The estimates used from planning budgets are published between 1988 and 2002 (publication dates vary on a commodity basis).

The two sources use different methods, as the yield estimates are used for different purposes. At this point the two sources are the most accurate information available.

Yield estimates are mostly based on production in the Fraser Valley and Okanagan regions. In addition, average yields differ for processing crops as compared to fresh market sales. This data is not available for all processing crops and for consistency purposes is ignored in this study. It should be noted that only a small percentage of B.C.'s crops go for processing.

A complete list of average yields for crops grown in BC would be an asset for future versions of this study. This data should take into account regional growing/management differences and crops for processing, as crops for processing typically have higher yields.

The estimated waste factors applied to food "Disappearance" data in "Food Statistics" are experimental. Likewise, the methods in which these factors are applied to estimated production are experimental.

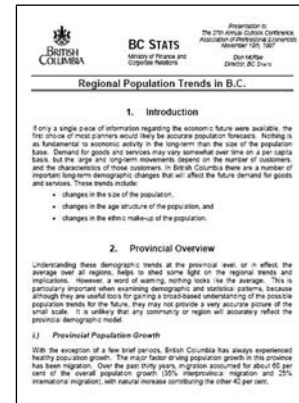
²⁵ The Crop Insurance program is a production insurance program for farmers of specific crops. Farmers pay an annual premium for coverage against crop failure. Payouts are based on 'average yields'.

²⁶ Ministry of Agriculture and Lands did a series of planning budgets (*Planning for Profit*) for different crops and livestock. Part of the planning budget involves estimating production.

The weight per serving for fruits, vegetables and grain products are estimates. The USDA National Nutrient Database is a standard reference; however, matching difficulties between consumption, production, recommended consumption and the database do occur.

“Food statistics”²⁷ were first published in 1976, and similar studies have been done to note changes in consumer behaviour with the release of new health information. Insight could be gained on a provincial basis by comparing changes in BC production, since farmers typically alter production in response to consumer demand. Further analysis could also indicate how fast BC farmers can respond to changes in consumer behaviour.

Taking demographics into consideration in this study offers valuable information now and in the future. In a ten year period B.C. will see a major demographic shift. The major variables of the shift will occur as outlined in *Regional Population Trends in BC*²⁸, are changes in the age structure, size and ethnic make-up of the population. Measuring these changes can help shed light on how B.C.’s food needs shift with demographics.



8. Methodology and Detailed Analysis

8.1 Consumption and Production data

Per capita “food disappearance” and “actual consumption” is disclosed in Stats Canada’s annual publication, “Food Statistics.” Consumption data for 2001 is used in comparison to production data from the 2001 Census. Total B.C. food consumption is based on the reported population of B.C. for 2001 (3,907,740 persons).

Food Statistics refers to “Food Disappearance” as the amount of food available for consumption. B.C.’s food self-reliance, on a commodity basis, is the ratio of B.C. production to “Food Disappearance” data.

The amount of recommended food intake is the amount of food that is actually consumed rather than the amount of food available for consumption. To determine self-reliance on a food group basis, “Food Disappearance” data and B.C. production estimates are adjusted to account for food wastage. These adjustments produce comparable data to Health Canada’s recommended food consumption. In “Food Statistics” the consumption data adjusted for food wastage is referred to as “Actual Consumption”.

The waste factors used to calculate “Actual Consumption” account for retail, household, cooking and plate loss. The waste factors may vary from year to year. This study used waste factors on a commodity basis for consumption data averaged over three census years, 2001, 1996 and 1991.

²⁷ Statistics Canada Catalogue no. 21-020-XIE

²⁸ A publication of B.C. Stats, <http://www.bcstats.gov.bc.ca/data/pop/pop/apebc97.pdf>

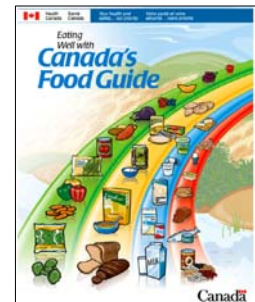
The estimated weight per serving differs on a commodity basis for raw and processed foods. Similarly, for consumption data, processed commodities have different waste factors than fresh products. In order to get production data in the same terms, the percent of production to processing on a commodity basis is estimated. The percent to processed sales for 2001 is applied to estimated production to get the amount of production to processing on a commodity basis. The amount of production that goes to processing is adjusted by a waste factor for comparison to consumption data. The adjustment results in a better estimation of what is actually consumed from what B.C. farmers produce.

B.C. production is estimated by using the reported producing area for 2001 multiplied by the average yields. Average yield estimates are derived from “Crop Insurance” data and Ministry of Agriculture and Lands commodity planning budgets. Yield data from “Crop Insurance” are considered a better estimate and are used when available. Otherwise, the “average” yields from Ministry of Agriculture and Lands planning budgets are used.

Consumption data for fruits and vegetables separates fresh and processed items. To determine BC’s self-reliance on a commodity basis, the processed amounts for fruit and vegetables are converted to its fresh equivalent weight for a fair comparison to production data. This conversion is not necessary for the comparison of recommended consumption and production data as recommended serving sizes differ between fresh and processed goods.

8.2 Food Guide Recommendations

The recommended consumption on a food group basis is from *Health Canada’s Food Guide to Healthy Eating*. The guide places food into the following four groups: “Grain products”, “Vegetables and fruit”, “Milk products”, and “Meat and alternatives”. Foods that are not included in these groups fall into the “Other” food category. These foods tend to be low in nutritional value and high in fat. Health Canada recommends citizens limit the intake of these foods for obvious health reasons. These items are not included in the approach to self-sufficiency on a food group basis.



The recommended number of servings an individual should consume everyday from the four food groups will vary with his or her activity level, body size, age and gender. For women, it will vary when pregnant or breastfeeding. The recommended daily intake is 5-12 servings of grain products, 5-10 servings of vegetables/fruits and 2-3 servings of Meat and alternative products. For milk products a more personalized recommended number of servings are given. The recommended intake for children 4-9 years of age is 2-3 servings per day. For youth 10-16 years of age the recommended intake is 3-4 servings per day. For adults the recommended intake is 2-4 servings per day, and if breastfeeding or pregnant 3-4 servings per day.

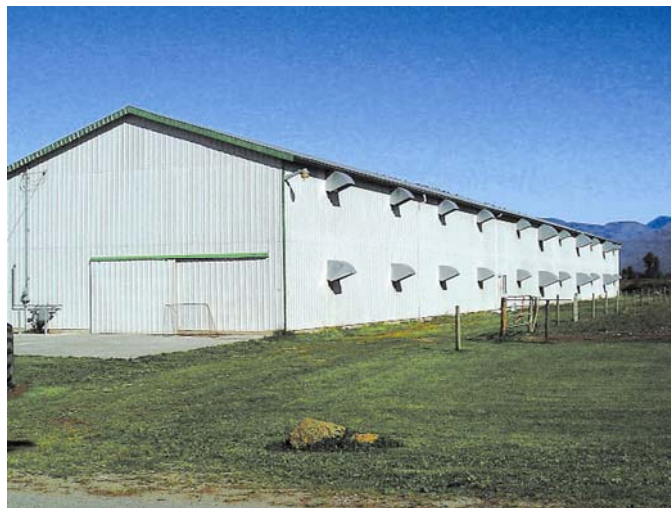
For comparison to production estimates and land needs it is necessary to find an absolute serving size per food group. Health Canada gives a range of servings to indicate to individuals that their consumption levels will vary based on personal characteristics.

BC’s demographics were considered while estimating an absolute recommended number of servings per food group. The main variables taken into consideration are age structure and the gender sex ratio. The 2001 “Average person profile” published by BC Statistics indicates: 25% of the population is less than 20 years of age, 36.3% is 20-44, 25.1% is 45-64, 13.6% is 65 and older, and the mean age is 38.4 years. The population is 51% female and 49% male.

After analysis of demographical information it is concluded that there is not significant evidence to take a number other than the average of the range for the number of recommended servings. The purpose of this estimation is to determine the number of servings that would meet the requirements of the indicated characteristics of the 2001 population.

A weighted average is used to find the average number of servings for milk products. The guide recommends a range of servings for this food group based on age and if pregnant or breastfeeding. The 2001 census profile gives the age distribution. Some age categories are not grouped the same between the food guide and census profile, thus, some estimates were made in the calculations. The 2000/01 birth population is used to give an estimate of the population that is either pregnant or breastfeeding.

For comparative analysis, consumption and production data is converted to servings consumed/produced per day. In order to accomplish this, a weight per serving on a commodity basis is necessary. The Food Guide discloses serving sizes on a weight basis for fluid milk and meat products. For the other groups it is not as clear cut. Refer to “Canada’s Food Guide to Healthy Eating” for serving size descriptions. For instance, the guide indicates that a slice of bread is equal to one grain serving. For conversion purposes, the amount of grain present in a slice of bread is estimated and used as the recommended serving size. The recommended amount for fruits and vegetables is also given as a qualitative description rather than measured by weight. To determine weight per serving on a commodity basis, the USDA National Nutrient Database is used to provide a standard reference. The weight of a recommended serving is estimated based on matching descriptions with the Nutrient database. Refer to the supplement material for more detail on how the tool is applied.



9. Data Tables

Excel spreadsheet in electronic form or attached hard copy.