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**AN ENVIRONMENTAL SCAN OF FACTORS RELEVANT FOR
SUSTAINABLE FOOD PRODUCTION IN NL**

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March 2014

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Executive Summary

The goal of this environmental scan was to gather information about socio-economic conditions and suitable growing technologies that can help create a food production strategy adapted to NL.

Despite the fact that there is great potential for the growth of the NL vegetable industry, there are a number of constraining factors such as:

- i. Difficulty in meeting the demands of the wholesale sector;
- ii. Lack of awareness among consumers about the qualities of local food;
- iii. Lack of growth in the industry (evidenced by decreases in vegetable production, decreases in numbers of producers, and low availability of local food).

Some very positive trends have been found amongst “niche” producers who use alternative marketing methods and grow a range of crops beyond the traditional root crops. These producers benefit from an informed consumer base that demand local food and demand a diversity of products. Such small-scale trends are invisible within available statistics on NL local food production and are therefore insignificant or require further investigation and data collection.

In terms of technological innovations, vegetable producers in NL can benefit substantially from the use of greenhouses. A number of producers are embracing a range of renewable energy technologies, however an important factor that can limit the adoption of new technologies in NL is the lack of expertise at an institutional level and the lack of knowledge sharing among producers. This issue is partially being addressed by the current NL Growing Forward 2 program, which supports innovations in the agriculture industry (including greenhouses) and the development of research expertise in the province.

This scan was performed over a timeframe of three months and therefore only provides a brief snapshot of the current state of the local food production atmosphere and innovations. To gain broader representation of innovations and technologies being employed by producers and also to create cost comparisons of these technologies, a lengthier timeframe is required.

Background

The goal of this environmental scan was to gather information about socio-economic conditions and suitable growing technologies that can help create a food production strategy adapted to NL. MUN Botanical Garden in partnership with researchers from the Division of Community Health and Humanities requested this initial scan in order to inform future projects that aim to increase local food production in the province. There were two aspects of this environmental scan. The first was a review of socio-economic factors which impact local food production. This review of socio-economic factors includes available statistics on cost of production and market fluctuation, relevant reports of food preferences of Newfoundlanders and Labradoreans and a handful of interviews with local food producers and marketers. The second part of the scan was a review of technologies and innovations that might help maintain environmentally and economically sustainable food production in NL. There is a focus on renewable technologies, season extension technologies and alternative marketing strategies.

Significance in Relation to Existing Research and Literature

The environmental scan developed here aimed to fill a gap in knowledge identified by Vodden et al. in a recent study funded by the Harris Centre. Vodden's study revealed that restricted technology/education flow and inadequate market information are barriers to agriculture in NL(1). This scan compiles available statistics and research into the market for local vegetable production and documents the adoption of innovative practices among some local producers.

Two additional and compounding features of our current food system that drive the need for this research are a lack of a secure food supply and the inability to recruit and retain a population of farmers to replace those that are aging(2). At the same time there is rising public awareness the health of locally grown food and an increasing need for skilled workers in this industry (2, 3). While some research exists on this topic (4, 5), there remains a need to further develop this research.

Theoretical Approach:

Underlying this research is the theory that the development of food secure communities depends on sustainable food systems where locally produced vegetables are accessible, affordable and grown in an environmentally friendly way (6). An enhanced understanding of the underlying socio-economic factors that facilitate or inhibit sustainable local food production and a description of 'green' innovations in integrated greenhouse production will provide knowledge about what issues there are in creating a sustainable food system and how these issues can be addressed.

Part 1: Socio-Economic Factors Influencing the Production of Local Foods

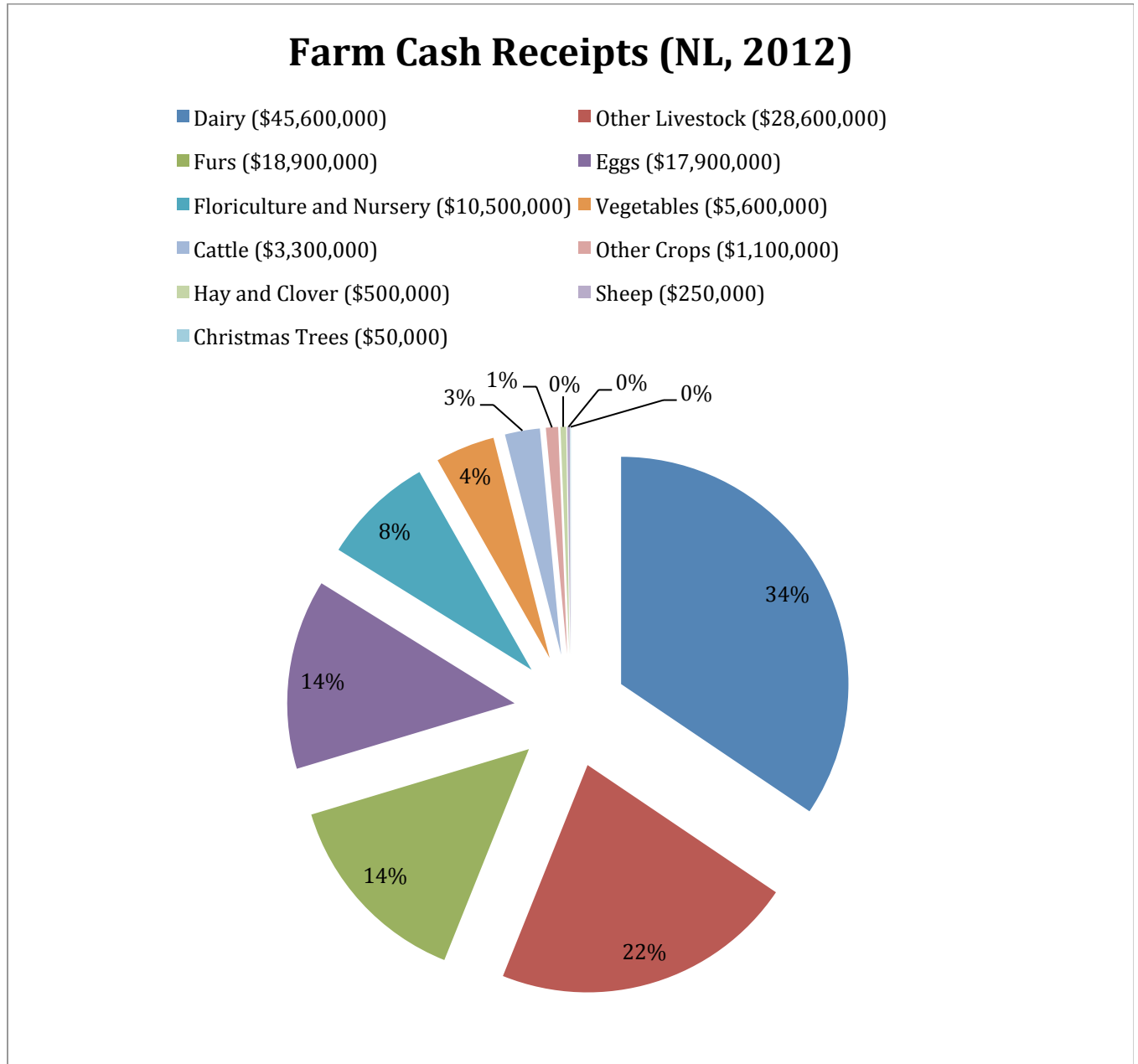
The following section is meant to provide some background statistics on current production levels of field vegetables and greenhouse vegetables in NL. Almost all of the statistics gathered below come from Statistics Canada. One issue with these statistics is that many values from the vegetable farming industry in NL are deemed by Statistics Canada to be too unreliable to be published or the values have been suppressed to meet the confidentiality requirements of the Statistics Act. This is due to the fact that there are insufficient numbers of vegetable farmers from NL engaging in these surveys to form an accurate representation of the vegetable industry in NL. Thus interesting trends in the growth of local food production and diversification which can be observed in different locations throughout the province are not visible or perhaps, not statistically significant on a large scale. The lack of accurate statistics is a barrier in gauging and responding to trends in local food production.

Current Field Vegetable Production in NL

Similar to trends across the country, farms in NL are getting bigger or getting out, 9.4% (48 farms) of all farms in the province accounted for 80.4% of total provincial gross farm receipts¹ for the year 2010. Between 2005 and 2010, Newfoundland and Labrador's gross farm receipts increased 11.5% (at 2010 constant prices) to \$137.6 million. This increase was much higher than the 3.9% increase in gross farm receipts at the national level between 2005 and 2010 (7). The most likely benefactors of these increases in farm receipts are the dairy, egg, chicken and fur farms. Figure 1 below gives a visual representation of the relative value of vegetable production when compared with other types of farming in NL.

The total farm area in Newfoundland and Labrador decreased 13.5% between 2006 and 2011. Farms in Newfoundland and Labrador averaged 152 acres in 2011, down from 160 acres five years earlier. In 2011 there were 150 reported farms with a total of 886 acres. A benefit to be gleaned from the trend of less land being farmed in NL is that any discussion or plan for further development and expansion of the Vegetable Industry in this province is not limited by the amount of available and suitable agricultural land. The combination of vacant farmland and the potential for newly cleared land means there is sufficient land available to meet the needs of any foreseeable expansion of the industry(8).

¹ The value the farmer receives for products sold.

Figure 1. Farm Cash Receipts for NL (2012)

Source: NL 2012 Farm Cash Receipts (9). All numbers have been rounded to the nearest thousand for ease of interpretation.

Table 1. NL Vegetable Acreage (acres).

	2006	2011
Potatoes	n/a	500
Rutabagas and Turnips	341	253
Carrots	220	217
Cabbage	191	175
Beets	69	58
Pumpkins	33	35
Broccoli	60	22
Sweet Corn	33	11
Lettuce	27	10
Squash and Zucchini	10	8
Dry Onions	6	5
Cucumbers	6	4
Tomatoes	4	3
Green Peas	6	3
Green and Wax Beans	5	3
Brussel Sprouts	X	3
Shallots and Green Onions	1	1
Spinach	1	1
Peppers	1	1
Asparagus (non-producing)	0	1
Cauliflower	11	X
Chinese Cabbage	2	X
Celery	1	X
Radishes	1	X
Total Acres	1029	811

Table 1 provides a list of the vegetables produced in NL in the years 2006 and 2011. The vegetables are ordered from those most commonly produced to those least commonly produced. Turnips, carrots and cabbage reign in terms of acres under production. The only crop to see an increase in acreage between 2006 and 2011 is the pumpkin. The pumpkin may not actually belong in this table because it is less a 'vegetable' crop and more of an 'ornamental' purchased for Halloween. All of the rest of the crops show decreases in production.

An important fact to consider in the reading of this table is that these numbers are collected as part of the Census of Agriculture which collects information only from a sample of farmers in NL. Because there are few vegetables farmers in NL, these data do not provide an accurate representation of crops produced, especially those that are produced in a smaller amount, such as spinach. The lack of accurate statistics for smaller scale production in NL is an impediment to understanding changes in this industry.

Source. Statistics Canada, 2011 Census of Agriculture, Farm and Farm Operator Data, Catalogue No. 95-640-XWE) (10). Potato Data from Statistics Canada. Table 001-0014 - Area, production and farm value of potatoes, annual(11).

(X= Suppressed to meet the confidentiality requirement of the Statistics act; 0 = True zero or value rounded to zero)

The following table organizes the top eleven vegetables grown in NL according to the number of acres grown and the farm gate value (the amount that the farm received for the vegetables is contained in brackets). Included next to each vegetable is the production in tons produced for 2013. The crops without values were deemed by Statistics Canada too unreliable to publish.

Table 2. Top Eleven Vegetables Currently Grown in NL acres, value and tonnage

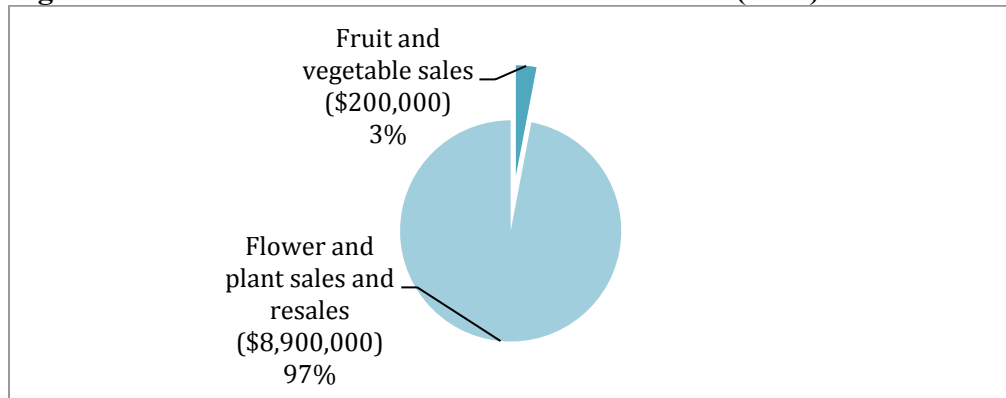
	2011	2012	2013
	Acres/ Value \$	Acres/ Value \$	Acres/ Value \$
Potatoes (4470 tons)	500 (\$2,000,000)	500 (\$1,800,000)	500 (n/a)
Rutabagas and Turnips (2506 tons)	234 (\$1,400,000)	205 (\$1,700,000)	214 (\$1,800,000)
Carrots (1270 tons)	151 (\$1,000,000)	145 (\$900,000)	194 (\$1,100,000)
Cabbage (991 tons)	125 (\$800,000)	134 (\$700,000)	213 (\$700,000)
Beets (213 tons)	78 (\$70,000)	134 (\$130,000)	213 (\$200,000)
Parsnips	16 (\$16,000)	11 (\$11,000)	F
Lettuce	11 (\$47,000)	9 (\$58,000)	11 (f)
Pumpkins (138 tons)	17 (\$39,000)	11 (\$50,000)	18
Squash (13 tons)	F	2 (\$16,000)	5 (\$18,000)
Peas	F	1 (\$2000)	F
Dry Onions	(\$2000)	(\$2000)	1 (\$3000)

Source: Statistics Canada. Table 001-0013 - Area, production and farm gate value of vegetables, annual; Statistics Canada Table 001-0014- Area, production and farm value of potatoes (11, 12).

Current Greenhouse Vegetable Production in NL

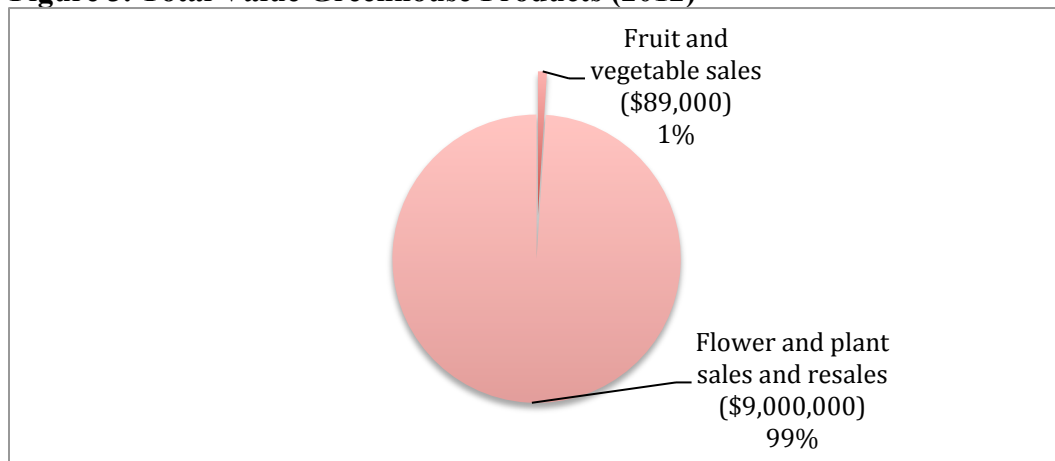
The statistics available for greenhouse production also suffer from the amount of data suppression. The scale of NL's greenhouse industry is a barrier in terms of finding useful production statistics. Some greenhouse production might not be accounted for which makes it difficult to track new trends in the greenhouse vegetable industry.

Figures 2 and 3 show the total value of greenhouse products for the years 2009 and 2012. The data for 2010 and 2011 are not displayed in pie chart because values for greenhouse fruit and vegetable sale for both those years are deemed too unreliable to be published. There was a slight decrease in the value of greenhouse products between 2010 and 2009. In terms of greenhouse fruit and vegetable sales, there was also a slight decrease. The category "Flower and plant sales and resales" includes flowers and plants that are grown in NL-greenhouses but also flowers and plants that are bought by greenhouse producers from outside of the province and then resold.

Figure 2: Total Value of Greenhouse Products in NL (2009)

Source: Statistics Canada. Table 001-0051 - Total value of greenhouse products, annual (dollars) (13). The numbers have been rounded to the nearest hundred thousand for ease of interpretation.

These charts demonstrate what a small percentage of greenhouse production is vegetable production. This trend contrasts with a recent trend in the U.S. where growers are switching from flower to vegetables. Michigan State University just released a series called, “Will greenhouse-grown vegetables replace ornamentals in U.S. greenhouses?” as growers are facing increasing difficulties competing in the ornamental market but feeling the demand for locally grown (and organic) vegetables (14).

Figure 3. Total Value Greenhouse Products (2012)

Source: Statistics Canada. Table 001-0051 - Total value of greenhouse products, annual (dollars) (13). The numbers have been rounded to the nearest hundred thousand for ease of interpretation.

In NL in 2006 there were 88 farms reporting that they had crops growing in greenhouses, 33 of these reported to be growing vegetables with a total greenhouse area of 55,516 square feet (about 1.25 acres). In 2011, there were 76 farms reporting growing under greenhouses with 25 of these operations reporting the production of vegetables

(36,939 square feet, or about .75 of an acre) (10). Thus, in 2006, 38% of greenhouse production was in vegetables and in 2011, this decreased to 33%. For a contrast, Ontario in 2011 had 134,000,000 square feet (3065 acres) under greenhouses and 64% of this area (86,000,000 square feet, or 1974 acres) was in vegetable production. Table 3 shows the production and value of greenhouse vegetables in NL from 2009-2012.

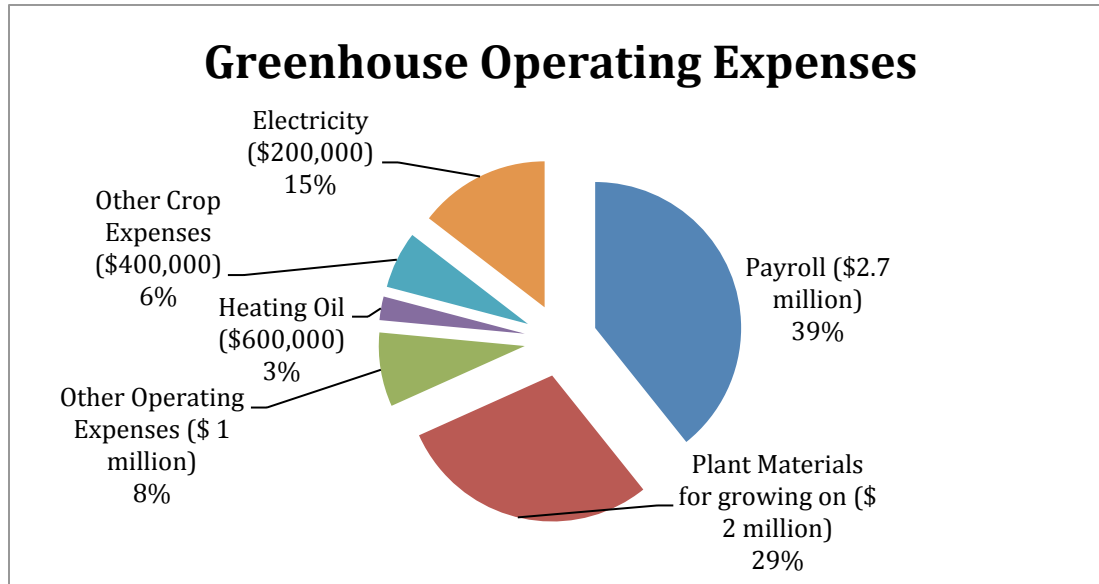
Table 3. Production and Value of NL Greenhouse Vegetables

		2009	2010	2011	2012
Tomatoes	Area Harvested (square feet)	17,000	25,000	9600	18,400
	Production (lbs.)	13,000	18,000	9300	19,300
	Farm Gate Value (\$)	17,000	24,000	9800	22,100
Cucumbers	Area Harvested (square feet)	1400	1600	3700	2600
	Production (lbs.)	n/a	n/a	3600	F
	Farm Gate Value (\$)	2200	2400	4500	F
Lettuce	Area Harvested (square feet)	X	F	F	1500
	Production (heads)	X	X	F	31,000
	Farm Gate Value (\$)	X	X	F	F
Peppers	Area Harvested (square feet)	2700	2900	3000	3400
	Production (lbs.)	6700	5100	2600	F
	Farm Gate Value (\$)	F	7500	4700	F

Source: Statistics Canada. Table 001-0006 - Production and value of greenhouse vegetables, annual(15). (F= too unreliable to be published; X= suppressed to meet the confidentiality requirements of the Statistics Act. The numbers have been rounded to the nearest hundred for ease of reading.

Figure 4 below shows the operating expenses for greenhouse producers in NL. Labour is the highest expense, followed by plant materials and electricity.

Figure 4. NL Greenhouse Producers' Operating Expenses (2012)



Source: Statistics Canada. Table 001-0052- Greenhouse producers' operating expenses, annual (dollars) (16). Two values in the table were suppressed to meet the confidentiality requirement of Statistics Canada: Plant Materials for resale and Natural Gas. The numbers have been rounded for ease of interpretation.

NL 2007 Agrifood Report

A report published in 2007 entitled “Wholesale and Other Opportunities in the Vegetable Industry of NL” provides a comprehensive overview of the current production levels and potentials for the vegetable industry in NL (8). The current supply of field-grown vegetables in the province and supplied to wholesalers (based on statistics from 2005) includes 15 different vegetables² (4, 961,187 lbs.) grown on 320 acres with a value of \$1,815,892. Based on the current demand of the wholesale market in NL, this report states that if producers increased their storage capacity and capability, local production of the same 15 field vegetables could increase to 45 million lbs. (requiring 2800 acres) with a value of \$15.5 million dollars. In other words, the current vegetable industry only provides about 10% of the current wholesale market and there is plenty of room to grow given adequate storage facilities. (These figures come from Table 18 of the Wholesale report included as Appendix A in this report).

² Listed in order from most valuable to least valuable (Potato, Turnip, Cabbage, Carrot, Broccoli, Parsnip, Yellow Onion, Head Lettuce, Corn, Romaine Lettuce, Cauliflower, Field Tomato, Green Onion, Celery, Beet)

While most producers do currently have storage capacity, improvements are required to maximize the potential for local production. When asked what field vegetables they would most like to purchase from local producers, wholesalers indicated rutabaga, carrot, cabbage and potato. In terms of non-traditional vegetables, this report finds that the vegetables with the greatest potential for local producers (listed in order of potential) include broccoli, lettuce, cauliflower, celery, corn and field tomato.

An addendum to this report provides Labrador relevant data (17). For the most part, the situation of the vegetable industry in Labrador echoes the findings from the island portion of the province: local produce is in high demand and deemed to be lacking in availability. It was identified that in Labrador, in 2009 local produce required approximately 1 acre to grow and represented .3 percent of the 4,711,241 pounds of fresh vegetables purchased by retailers. With full cool storage capacity and capability, Labrador producers could supply the Labrador retail industry with close to 86% of total retail fresh vegetable requirements. Retailers in Labrador believe potato, rutabaga and lettuce are the top vegetables that should be produced, next onion, carrot and cabbage. Producers in Labrador spoke about a shortage of local skilled and willing labour which delays production expansion.

In terms of greenhouse production this report finds that there is significant potential for locally grown greenhouse produce in this province, "...given the short growing season in Newfoundland, the greenhouse approach to supplying vegetables may ultimately be the best solution for consistent supply and managing quality is simpler in a closed environment such as a greenhouse." The potential market for greenhouse vegetables in the province was calculated based on the current pounds of vegetables being purchased at the wholesale level and the potential production numbers if these crops were to be grown 9 months of the year (assuming during the coldest months operating costs may be too high to be competitive). Below I have included Table 24 from the Wholesale report which outlines the potential for a number of greenhouse vegetables. This table demonstrates, for example, that we currently supply 2.2% of the total wholesale purchases of cucumber (10,060 pounds of cucumber). If production levels increased (growing 9 months of the year) to the demanded 307.254 pounds, the potential value of the cucumber industry grows to \$485, 462.

Table 4. Reproduction of Table 24 from page 15 of “Wholesale and Other Opportunities in the Vegetable Industry of NL” (8).

Table 24: Potential Wholesale Market for Greenhouse Crops.						
	Wholesale Purchases (lbs)	Locally Supplied (lbs)	Percent	Potential Market (lbs)	Estimated Value	Estimated Production Area (sq ft '000)
Cucumber	460,651	10,060	2.2%	307,254	\$485,462	15
Lettuce - Leafy	430,344	95,300	22.1%	322,758	\$316,303	34
Mushrooms	1,015,484	0	0.0%	1,015,484	\$2,366,078	59
Pepper - Green	733,690	10,400	1.4%	550,268	\$946,460	92
Pepper - Coloured	535,117	0	0.0%	401,338	\$995,318	67
Tomato - Standard	1,071,484	39,274	3.7%	803,613	\$867,902	80
Tomato - Cherry/Grape	184,040	0	0.0%	138,030	\$445,837	35
TOTAL					\$6,423,359	382

Information about the number of potential crop cycles annually and the estimated value for each crop calculated using prices quoted by InfoHort are included below as Table 5. The mushroom numbers are based upon a full year of production since mushrooms do not require a typical greenhouse but do require special houses equipped with ventilation and production occur throughout the year. These estimations deem a potential market for greenhouse crops to be valued at \$6.4 million.

Table 5. Reproduced from page 15 of “Wholesale and Other Opportunities in the Vegetable Industry of NL” (8).

Appendix 4: Greenhouse Vegetable Unit Price and Production Data.			
	Price per Pound*	Production (lbs/ft ²)	Maximum Crop Cycles per Year
Cucumber	\$1.58	10	3
Lettuce - Leafy	\$0.98	1.25	10
Mushrooms	\$2.33	5.75	4
Pepper - Green	\$1.72	6	1
Pepper - Coloured	\$2.48	6	1
Tomato - Standard	\$1.08	10	1
Tomato - Cherry/Grape	\$3.23	4	1
* Based Upon InfoHort Pricing as of October 16, 2006 (F.O.B. Halifax to St. John's).			

This report included information gained from conversations with Sobeys and Dominion who indicated that they are interested in purchasing NL-grown greenhouse produce (such as tomatoes, peppers, lettuces) because of the advantage in freshness. Dominion indicated a significant opportunity for romaine, iceberg and leafy lettuce. Both retailers indicated a willingness to pay local producers the equivalent price that they pay for imported produce. This would mean Newfoundland and Labrador producers would receive the same price paid for produce on the mainland plus the freight charges to deliver the produce to this province. These retailers also indicated a willingness to

promote locally grown vegetables in their advertising. The challenge is that these retailers require consistent quality and level of supply to operate successfully. Also, both retailers indicated that greenhouses be located within easy access (close proximity to the warehouses or economical transportation).

Meeting the Demands of the Wholesale industry in NL

To summarize this report, there is a great deal of potential for the growth of the vegetable industry in NL but there are a number of demands and constraints on the growth of the vegetable industry in NL. Firstly, producers need to expand current operations to include alternative crops in addition to increasing acreage for traditional crops. The demand for “alternative crops” reflects changing consumer trends: demand for traditional root vegetables, particularly in the St. John’s region is decreasing, while demand for vegetables such as broccoli, cauliflower, tomatoes and lettuces is increasing. Constraints to supplying this increase in demand include:

- i. The industry is slow to adapt: Amidst the changing demands of consumer, the reality is that there have not been significant changes in the agronomic and business practices in the local vegetable industry in the past 20 years. Stability in practice might also be linked to the fact that the age of the average farmer is 55(10).
- ii. Incentives are low: This report notes the challenge for vegetable farmers in receiving a fair and equitable return on investment since the average price per pound for traditional vegetables has remained relatively flat for many years. Meanwhile the cost of production is increasing. The costs of transporting crop inputs across the Gulf are passed on directly to producers.
- iii. Skills needed to evolve: In order to respond to changing demand, producers need to pursue and also need access to the necessary information for diversification into alternative crops and appropriate varietal selection of traditional crops. Farmers must have access to information, technical horticultural knowledge and appropriately designed training in order to improve production and diversify with confidence.
- iv. Retailers and wholesalers require consistent quality (Canada no.1) and consistent supply: They need to know the types of vegetables that will be offered, quantities, agreed upon pricing and expected delivery dates. This would be facilitated if farmers could effectively and collectively engage with the retail sector however, infrastructure and perhaps willingness is lacking to support a coordinated production and marketing effort.
- v. Communication among farmers is essential: Farmers must have effective ways of communicating with each other in order to create and maintain a

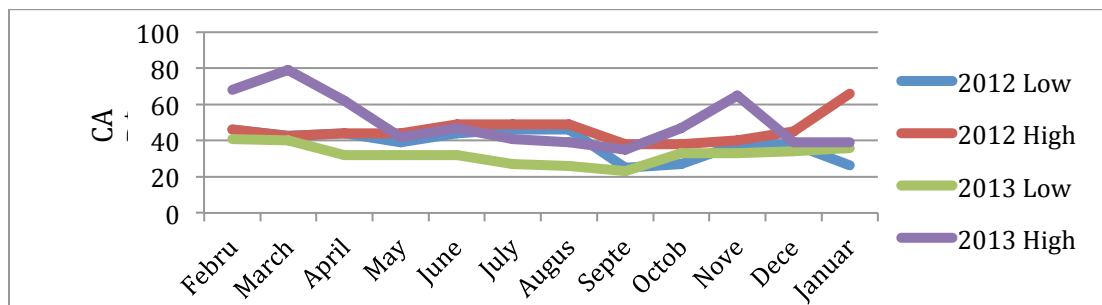
common understanding of common issues and current production and marketing conditions.

- vi. Local products are not always marketed by the retailer as “local” and local is not always valued by the consumer: An increase in the promotion of the “local foods” in the province is required through all forms of media and markets.
- vii. Finding skilled and willing labour is difficult: This trend is echoed throughout Canada and North America and evidenced by the increasing number of migrant workers on farms.

Pricing Data for a Sample of Green Vegetables in St. John's

To demonstrate pricing data for a sample of three vegetable crops that could be grown with relative ease in NL greenhouses (lettuce, herbs and kale), I accessed Infohort, an information collection and dissemination system which provides current and historical data on horticultural commodities across Canada (hosted by Agri-culture and Agrifood Canada). The price quoted represents the wholesalers 'asking price' to the retail level (in St. John's) for a commodity and does not represent any arrangements or deals. One obvious trend seen below is a general dip in price during the summer season which presumably reflects a greater supply of these vegetables.

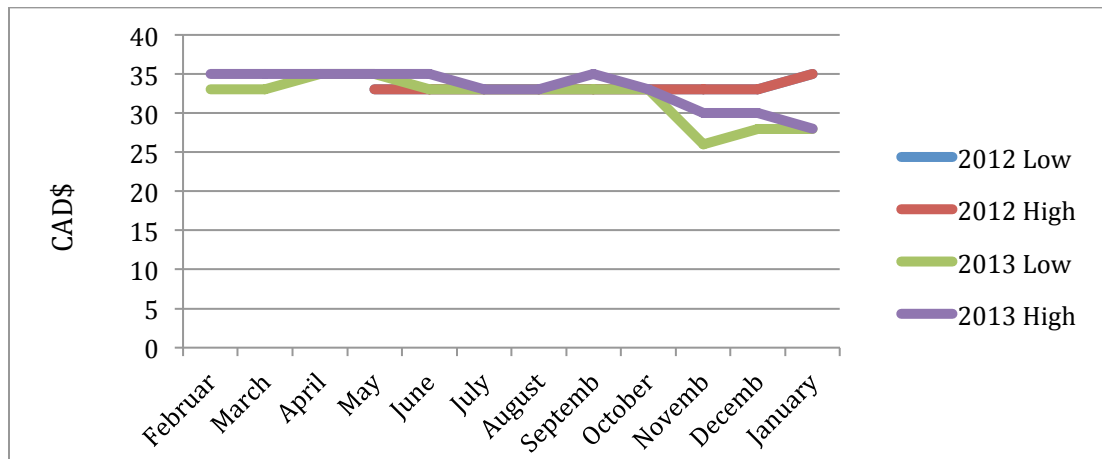
Figure 5. Monthly summary of weekly wholesale to retail market prices for a Lettuce Container (24 plants).



Source: Infohort (18)

Figure 6 tracks the amount that the retail stores will pay wholesalers for a container of 30 bunches of cilantro. These numbers are surprisingly consistent throughout the year. For this reason, the blue line for 2012 low does not appear because the numbers are the same as 2012 high.

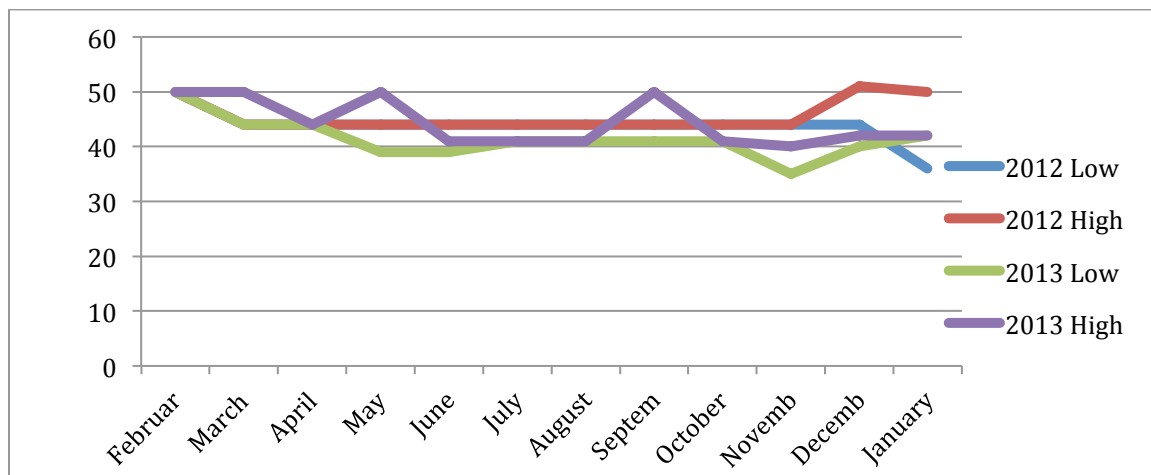
Figure 6. Monthly summary of weekly wholesale to retail market prices for a Herb Container (24 bunches of Cilantro).



Source: Infohort (23).

Finally, Figure 7 shows the variation in prices that retail stores will pay wholesalers for a container of 24 bunches of kale.

Figure 7. Monthly summary of weekly wholesale to retail market prices for a Kale Container (24 bunches).



Source: Infohort (23).

The provincial department of Natural Resources published a series of Vegetable and Fruit Weekly Market Report detailing prices in 2011(19) and they used a formula of adding 30% to these above prices to determine the retail price. A marketing report summarized below speaks to the fact that retail pricing can no longer be understood as a simple mark-up of the farm price and is increasingly difficult to understand. This is due to the fact that retailers hold so much power in the market and offer such a variety of products. Perhaps this is why in the above figures there appears to be such uniformity of

pricing throughout the year. A crop's price does not appear to be as impacted by seasonal changes as one might expect for an agricultural product.

Newfoundlander's and Labradoreans Readiness for Local Food

In 2005, the Atlantic Canada Food Consumer Study report was prepared for the Council of Atlantic Premiers (20). Some interesting findings from this report were that grocery shoppers tend to stay in their comfort zone purchasing the same brands of products each time they shop and have developed well-ingrained buying habits. The majority of shoppers in Atlantic Canada name Sobeys or Loblaws as the grocery retailer they visit most frequently. Thus these chains wield considerable control over distribution of food products in Atlantic Canada. This report found that retailers have the greatest influence in persuading shoppers to purchase food items they would not ordinarily buy and that in-store specials have a significant influence over prompting shoppers to try new or different food products. Only 2 out of 10 shoppers consider "locally produced" to be a critical factor in food purchase decisions. The most important factors for shoppers when buying fresh vegetables are taste and quality. 'Supporting the local economy' is the key benefit that shoppers see to purchasing local food products. Strangely, freshness and quality do not emerge as key benefits. However, fresh vegetables are the most popular local food category. This report concludes that effort is needed to change public perception about the qualities of local food. Shoppers in Atlantic Canada are willing to consider purchasing local food products even if they are somewhat more expensive as long as the product is not perceived to be of lower quality than their favorite brand. Four out of 10 grocery shoppers indicated endorsement of products by local farmers would influence them to choose local products; only 3 out of 10 consider grocery stores credible endorsers and surprisingly a mere 2 out of 10 consider health experts or doctors credible sources. Labels and in-store signage are the two most important sources of information about the origin of local food products. This report concludes that governments should partner with grocery retailers and local farmers to successfully promote local food products to Atlantic Canadians – offering compelling reasons such as freshness(20).

Another study provides information on the development of direct marketing in Atlantic Canada. It was prepared by Kelco Consulting Ltd. for the Council of Atlantic Premiers (21). Direct marketing is viewed as a strategy for farmers to face challenges of an increasingly globalized food system (higher input costs, increasing regulatory burden, increasing competition, and pressures on pricing). Direct marketing consists of roadside or tailgate, farmers' market, u-pick, mail order, restaurant, CSAs (Community Supported Agriculture)³, Farm stand or store, Flea market, home delivery, internet orders, grocery store, wholesaler/ broker. This study found that, "Direct marketing can become a major method of import replacement in the food value chain in NL" (p.64). Programs to increase direct marketing can be benefitted with an extended production season, the

³ CSA: a direct marketing model where a group of individuals pledge to support one or more local farms, with growers and consumers sharing the risks and benefits of food production. CSA members pay at the beginning of the growing season for a share of the anticipated harvest; once harvesting begins, they receive weekly shares of vegetables and fruit.

development of processed products that lengthen storage periods and attract consumer attention, and an understanding of how to manage production of a diversified farm operations. This report also included some interesting trends in the Canadian population derived from a 2005 report entitled “*Canadian Food Trends to 2020: A Long Range Consumer Outlook*. Firstly, Canada has an aging population who are a large part of the existing clientele for direct marketing operations. The question raised is: do older customers purchase direct from producers because of some characteristic associated with their age and social situation or is purchasing direct a feature of this age cohort that will disappear when they are replaced by other aging cohorts? Also, Canadian consumers will continue to demand healthier products in tasty and convenient forms. Due to the demands of the changing Canadian demographic (a growing proportion of non-European immigrants) an increasingly broad range of products will have to be grown. Finally, consumer confidence issues will become more important over time: with consumers growing more aware of the importance of freshness, environmental impacts, processing technologies, additives and preservatives(21). When comparing Newfoundlanders and Labradoreans to Canadians it is important to remain aware of significant differences in food consumption patterns, in 2012, the Centre for Health Information released a report based on findings from the 09/10 Canadian Community Health Survey which find that NL has lowest percentage of individuals meeting the daily recommended requirements of fruits and vegetables(22).

Broader Context

Looking outside Newfoundland and Labrador, there is evidence of a rising demand and interest in local food production. Most notably, Ontario has passed a Local Food Act, 2013. The three purposes of this act are to: 1. Foster successful and resilient local food economies and systems throughout Ontario; 2. Increase awareness of local food in Ontario, including the diversity of local food; and 3. Encourage the development of new markets for local food (23).

A report published by the NS Department of Agriculture documents the growing number of local food initiatives in Nova Scotia, Canada, the United States and in Europe(24). This NS-produced report is relevant to this environmental scan because it is published close to home and documents a growing trend in making local food more accessible in public institutions. This report finds that as food imports increase and as production and distribution channels become increasingly consolidated, there are a growing number of research projects and initiatives arising throughout Canada that seek to support local food systems. In Nova Scotia, preliminary research has identified a number of barriers to procuring greater amounts of locally produced foods, including a) obtaining requisite volumes from small producers, b) working with a limited growing season, c) covering necessary costs and d) distribution.

There is a growing body of academic literature around the topic of the importance of local food production for building community food systems (25-27). An equally dominant trend reported in the literature is that retailers, oftentimes with international scope, have emerged as the dominant players in the food chain in most parts of the world.

These retailers (through marketing contracts) exercise considerable vertical market control over farmers in terms of varieties produced, inputs utilized, production schedules, etc. Little is known about grocery retailer pricing and promotion strategies or how these strategies affect prices at the farm level. Because of a high concentration of food retailers, there are concerns about their power to influence prices charged to consumer and prices paid to the farmers. Today the traditional model of knowing a retail price as a simple mark-up function of farm price has almost no predictive power. One complicating factor in grocery retail pricing is the multi-product nature of food retailing (modern U.S. supermarkets supply 40,000 or more distinct product codes). Increases in retailer market power can reduce purchases and sales causing lower prices at the farm gate and can be harmful to farmers if the prices do not adjust to shocks in the farm market, “Although consumers likely have benefitted from cost-reducing efficiencies introduced into the market chain and the entry of discount retailers, the impact on producers, especially small-scale producers, is probably less favorable.” (28).

Interviews

Method

In order to ground the statistics and marketing reports summarized above in the real experiences of producers and marketers in NL, I engaged in a number of open-ended semi-structured interviews. This project received full ethics clearance from the MUN Interdisciplinary Committee on Ethics in Human Research and informed consent was solicited from all participants in the study. Due to the fact that the project was to take place in a limited timeline of 3 months, I could engage in only 6 interviews. I approached two farmers that I knew in the Avalon region and three marketers, one from my local grocery store, another from a different grocery store and a third who has a new niche food market in St. John’s. The sixth person I interviewed was a representative from the NL Department of Natural Resources who specializes in marketing. A copy of the notes from these interviews was sent to each participant and a copy of the final report will be sent to the participants. It should be noted that these interviews do not give a comprehensive understanding of the experiences of all producers and marketers in NL. Further interviews would be necessary to gain the experiences of a wide range of producers and marketers.

Producers

The two producers interviewed for this study were vegetable producers who grow both field and greenhouse vegetables. One produced organic vegetables and the other produced conventionally grown vegetables. These two producers both availed of direct marketing as a large part of their marketing strategy, both have on-farm markets and cater to local restaurants and one of the producers also runs a Community Supported Agriculture (CSA) as part of their marketing strategy. It should be noted that these producers are not very representative of the average vegetable farmer in NL. However,

these interviews provide useful insight into the development of niche production and new trends in local food production in NL.

Notes from two interviews:

1. What kind of vegetables have you been more successful producing and selling to the local market? What kind of vegetables have not been so successful and why?

- Whatever is in season we have no trouble selling, we sell out of everything. Carrots, lettuces. In summer, greens. Plant a variety: Asian greens, kohlrabi, kale (increasing in sales like you would not believe). Need to grow with the market, listen to customers, have the basics. Plan to increase fresh beans, peas.
- Sprouts, lettuce, green onions, swiss chard, tomatoes, organic potatoes, garlic, garlic scapes, fennel, onions, carrots, broccoli, kale.

1a. Marketing:

- 98% of vegetables we grow are sold in our market. We always sold wholesale, including lettuce and broccoli, we walked away from this. If they didn't sell the imported produce, they wouldn't buy ours, even if we did our homework the year before. I had enough of that. The market started with the older people, now it's all ages, which is really good to see. We would like to have lettuce this year, have considered getting into hydroponics, but need to consider weather, etc.
- Most of our marketing is in direct sales to restaurants and farmers market and CSA. Can't overproduce on anything because of the CSA- we don't waste. CSA comes with a different set of problems: 10-15 hours a week in dealing with customers.

2. What do you consider as your highest costs in food production?

- Labour, we have invested in mechanical things that will reduce this cost, but still things need to be handled by hand: lettuce, cabbage, broccoli. Potatoes all done mechanically, strawberries by hand, turnip by hand. If you were processing, it wouldn't be as bad. Getting experienced labour a real problem.
- Salaries are 80-90% of cost because of organic management. Followed by seeds and energy.
- Weather- have no control. If it's sunny, bring water, but rain causes so much problems, damage to crops. Now in Europe see way more greenhouses in the fields.

- Finding organic amendments is a huge barrier. Costs a fortune in shipping to get organic potato seed, garlic and amendments. Shipping time and a half for potato seed. Eastern farmers co-op makes these purchases easier.

3. What are the biggest barriers to marketing local food?

3a. Dealing with Retailers/ Wholesalers

- When dealing with larger retailers you are in the hands of a bully. They do want local produce, require HACCP (Hazard Analysis and Critical Control Points) certification. Used to sell herbs but cut off when Dominion bought by Loblaw's, there was a new directive that all herbs come from Toronto.
- One example: A producer on west coast of the province sold 5 lb. carrots to the supermarket for \$1.80, the supermarket then sold the carrots for \$4.99. The farm gets very little of the price that consumer pays for it. Another example: Just before Christmas, a producer received \$.50/lb. for turnip and the market charged \$.80-.90/ lb.
- Here because we are on an island and dependent on imported goods, grocery stores lose from storms or when product is not here on time or is frozen, that is their loss, they need to transfer that loss to something else to survive. When the boats don't come, grocery shelves are empty. We have 2 days supply of food in province. Need to develop alternatives.
- Producers who sell wholesale, these past 3 years had to attain food safety regulation. One wholesaler requires producers to buy wax boxes. We invested \$16,000 in wax boxes and a reefer truck. When you bring your produce, they put a temperature gauge in, if doesn't register they don't take because of the impact on shelf life. Until this week the wholesaler wouldn't take our produce. Local guys were ok with it, but dealing with national guys, they kept putting it aside. It has been in storage since October. Finally they are starting to take produce (in Feb). It used to be they sought out local produce, but now everything needs to be done nationally, they don't have the same feeling towards our communities, that's a shame. Until we get our consumers asking for local. If you find in the supermarket local, they will not give any higher price than what it is. Sometimes they don't identify it.

3b. Difference in taste of local produce

- We deal with consumers who say they can taste the difference, can taste the most with carrots. Don't have to sweeten locally grown produce. Turnip from

other places hard to cook. We have to go back. We produce less than 6% of our own produce, not even producing own carrots and turnip. As farmers, less young people want to come into the industry. In our market that we have during the summer, we set a price, they might have specials making the products easier to get, but beginning and late in summer our price is still the same, we don't fluctuate price, we leave it there.

- Tastes better, lasts longer, higher nutrition, higher sugar, probably worth 50% more

3c. Need to educate consumer

- During time you grow food best, educate community you buy it and freeze it when it's available. Lettuce and that, easy to grow greens in your house, someway to teach people. We need to experiment more, need the right lighting, more people now grow sprouts, must be careful, need education. Variety of food equivalent in prices, some markets won't know the difference, our local potatoes have a higher price because there is quite a difference. In markets you can get second grades. 2lbs of carrots with splits, people will buy for penny carrots, soups, needs to be education. Often when we deal with customers with kids interested we say, you couldn't teach you child a better thing, in 20 years time, it's going to be harder to get food. I don't think people realize the necessity; you should have a 2-month supply of food in the cupboard. Our homes aren't suited to do that. Needs to be done with the planning of homes. Room needs the moisture, you need a good plan, years ago our houses weren't as tight. Getting air from outside, necessary.
- On shelves you see perfect thing, but how many thrown away, importance of education. Carrots don't all come straight, but still edible. A lot of people want the grade A.

4. *What are your opinions on local food preferences?*

- More people into juicing, more diversification, different varieties, everyone wants to try more different things.
- People want local. Now a lot of food comes from Mexico, China, that's really far away, I don't know how they sell it cheaper, by the time it gets here, same price.
- Many of us used to stick to the basics; people bought what was in season. Lettuce only in summer time, lots of canned stuff, not fresh stuff.
- Young people are more aware of that. They want local, they get to know the farmers, ask questions, some people want to stick with organics, we are

conventional, do practices to cut down on use of pesticides, if problem, we take care of it. We scout our fields, they come out pretty fast. We used to stay away from crops that would attract pests. People don't want to see the bugs in it. Not easy growing organic. We know we produce a healthy product; we eat it from the field. People are beginning to ask for local more.

- Helps as farmers, grow more knowing demand is there. Have constant customers coming, helps us plan, enables planning and growing. Have started crops some chefs around town knew, they come to the field and help guide, garlic, we tried to grow. Customers help us.
- I don't know. How can you understand? Could not predict recent trend for kale. The way we retail is not typical, growing upper end stuff. Over half of business with restaurants. Can't compete with traditional crops.

5. Are there any types of growing methods/ technologies you feel are particularly adapted in NL? What methods/ technologies would help you grow food more profitably NL?

5a. Greenhouses

- Row covers, mini greenhouses, not too high tunnels (ribs little over 6 ft. right in the center to accommodate to height of workers, no higher than 8ft. because of heavy winds). With a greenhouse, can have tomatoes in May, with lights, keep frost out
- End of year, use row crop covers, they preserve a lot of stuff.
- Get movable greenhouse to put out in the field, not as much maintenance as in the standard greenhouse.
- Most farms now will have a greenhouse, starting transplants. Expense of keeping greenhouse going and fear of losing in heavy weather. In December and January we don't get many heating units from sun, so a lighting system is needed, these are expensive.
- Many years ago, not many farmers tried tomatoes in greenhouse, that will change, farmers want to employ themselves and labour longer into the winter.
- Single best technology is greenhouses, the cheaper the better. High tunnels are promising but not in windy areas. Can triple production. Can be ¼ cheaper cost than regular greenhouse.

- Province and federal government really supportive of innovative technologies but greenhouses don't count as a technology⁴
- Greenhouses extend season for 2 months.
- This year we will start off with row crop covers and tunnels, start earlier, costs more money, rather than charge first crop, even price over the season. Just had conference out in Corner Brook. We have invested in high tunnels, Igor wiped them out. Then Leslie took them both away, our winds are getting crazy and interfering. A solution to put rebar down on angles, 4 ft. down into the ground.
- We have irrigation systems in. Machine will wake them up on their phones if there is a sign of frost and they will turn on irrigation so it doesn't get hurt. Strawberries row crop cover blanket, makes it 3 degrees warmer, protects from frost. More places, more rain, will see more crop under greenhouses.

5b. Marketing

- Direct marketing- at first we didn't know marketing was a new tool we had to learn.

5c. Computers

- iPhones, our workers go in the field find a problem, take a picture, e-mail to plant specialist, within minutes we have the answer.
- Now we have ipads out in the market to do cash. We love them, they tell everything, the boys will go in field, can go on iPhones and know they only have 20 heads of romaine lettuce. At end of year, they pressed on button, know how much we have set, sold, money from crops, we can do a lot of analyzing to know what to plant.

5d. Cover crops/ Alternative crops/ Soil enhancement

- Cover crops help crops grow. When early lettuce is finished we put grass in, it helps a whole lot.
- Sustainable agriculture needs rotation, need education.
- Last year we had a cold frame over the field, had Swiss chard until really late, yield on zucchinis not enough, kale we had almost until Christmas.

⁴ I discovered later that Growing Forward 2 does fund the building of greenhouses.

- More profit in flowers than vegetables. Seed for flower in March. By end of June, flowers sold, get more money per sq. ft. than from vegetables.
- Soil tech- anything to keep humus in soil. Green manure, cover crops. Fall rye, excellent cover crop, fava beans.
- Tillers- small narrow tillers can work well on a 2-acre farm.
- Tractors

5e. Knowledge Sharing/ Specialists

- Department of Agriculture has an abundance of knowledge. If you go to them, they will find avenues to go to. But with the internet, there is no limit, the farmer can look it up, go to agricultural representative for expertise. Some of them come up with things we like to try. Federal department of agriculture looking to extend seasons. 8-9 years ago couldn't grow corn, but now we can. Costs more to produce, maybe one cob per stalk. The yield not as high but it tastes good.

5f. Wind energy

- Wind turbines not working as much. Our winds not consistent enough.
- Wind mills should work well, high up front costs and not supported by government because perceived as competition for hydro development.
- Promise of windmills but province won't buy excess power

5g. Cooperating

- Hard to move equipment on the roads, gets complicated. A government sponsored rental place for tractors and tillers would be good.
- Storage for shallots, potato seeds. If you have a big farm can sell stuff in winter when the price is up. ACORN (Atlantic Canada Organic Regional Network) does storage in other maritime provinces.

5h. Geothermal

- Geothermal greenhouses use 1/4th the amount of electricity but big up front investment. If you had a big farm (10 acres), combine geothermal and wind power.

Marketers

I interviewed 3 marketers for this study. Two represented large retail stores and a third represents a smaller niche market.

Notes from three interviews:

1.What kind of vegetables have you bought from local producers in the past years?

- Root vegetables, potatoes, turnip, carrots, beet, romaine lettuce, chard
- Carrots, turnips, cabbage, parsnips, (these vegetables are called the ‘hard line’ in retailer lingo), lettuces, greens, berries, parsley plants, savoury, rhubarb
- Organic kale, zucchini, cucumbers, lettuce, tomatoes, peppers, shoots and sprouts, cabbage, potatoes, beets, onion, garlic, berries

2.Do you consider local food a viable product, why or why not?

- Very viable, in demand when available, if available would sell all year. It’s a superior product. Pay the same price as food from outside of province or pay more for it- don’t ever pay less than what we pay for veg from away. Much easier sell
- Sobeys has a commitment with a number of local producers who are geographically close, we are encouraged to buy local when possible, the price is set nationally. Benefits of local food- it supports local farmers, good for the area, Customers love local food. Greens highly perishable, subject to transportation and storage
- Yes, local eggs sell out fast, local foods needed in province, shipping majority of our produce is insane, pay double what you pay for other food. Need year round production.

3.How do you choose, procure, and promote food products?

- Procure- have standard farmers, they know that retail wants product, they grow product, give idea of how much will take, ex. collard greens: 8000 lbs. for season. Tell them we need this and they will accommodate. Farmers we buy from have an understanding. We have all we can take-can’t move product more than we do. Try

to stage things but it generally all comes at once. Advertise and promote local, known for that; push that, people want the product, they come quicker for this product, if you have cabbage, carrots first, it's an advantage.

- Promote local food with signage
- Look for organic, meet a lot of farmers, use ACORN (Atlantic Canada Regional Organic Network) as a network. Got to be good at ordering right amount, more likely to run out, also looking into making processed goods from extra. Tag things that are local. Advertise twitter, Facebook, farmer's market.

4. What are the barriers to marketing local food?

- No barriers, can't export; farmers can't move product; consistency, turnip greens sensitive product, root crops, less so. Weekly prices pretty consistent. Can freeze them- sell greens all year. Producers need storage facilities, controlled storage.
- Supply
- Lack of supply, awareness, demand is there. Want organic. ACORN gives average price you'll get at farmer's market. Prices higher in NL- on avg. more expensive to buy.
- Farmers have high cost of operation, riskier, crop failures. Better product. Smaller farms, smaller economy of scale. People will pay a premium.
- Prices higher in winter, summer things come from QC, NS, cost drops: romaine lettuce: 4\$ in winter, 2\$ in summer. In summer when the local crops are possible, local producers have a lower price to compete with.

Summary of Interview Content

An overarching theme from these interviews is the perceived viability of local food. Both producers and marketers shared the perception that the demand for local food was high. However, there is also an important distinction to be made between the kind of local food that is being demanded. The government representative that I interviewed made note of the fact that demand for produce is changing especially in St. John's for more diversified fresh produce. Marketers noted that at the height of the production season there is a cap on how much local produce can be purchased and also that at this time local produce has to compete with a cheaper product. The producers interviewed here did not share this marketing experience in their alternative marketing venues.

An important point that needs further investigation is a fact mentioned by the government representative that supermarkets can lose up to 50% on the produce they ship in because of deterioration of the product as it is shipped. Local food has a real advantage of freshness which is heightened in this province because of the distance that produce must be shipped to get here. However, the fact that local produce only represents a tiny corner of the market, while positive for local producers looking to expand production, means that for retailers supply is a real barrier in terms of depending on local produce. The issue of storage was one that was not mentioned by the producers interviewed above but is an important one for marketers and perhaps a contentious one for farmers as it requires a high degree of coordination and cooperation.

The use of greenhouses was recognized by both producers and the government representative as the single best technology for expanding production and also for diversifying production. One barrier to the adoption of new technologies and practices in NL is the fact that many producers are older and are less inclined to make changes to their practices.

All of the above trends enrich the data provided from the statistics and reports summarized above. There is no question that there is room for growth for local vegetable production in NL, the question remains whether local produce can realistically meet the demands of the larger retailers who seem to be playing on a different field. The question remains of whether local production is dependent upon alternative marketing structures.

An interesting difference between the consumers known by the producers interviewed above and the consumers interviewed in the consumer survey summarized earlier is that they appear to be unlike. The consumers who buy from the producers interviewed here have an interest in developing a relationship with their producer and seek out local food intentionally. Producers interviewed here still felt that more awareness needed to be raised among consumers to have them ask for local produce in their local grocery stores and to understand the advantages in freshness and also how to support local food production by freezing produce when it is most available.

Part 2: Technologies

Renewable Energy Technologies

Currently there are no provincial regulations in place to encourage the production of renewable energy(29). However, the Growing Forward 2 program in NL will be providing \$37 million to the agriculture and agri-foods industry over the next 5 years to promote innovation, competitiveness and market development, and adaptability and industry capacity(30). Growing Forward 2 is a five-year policy framework for Canada's agriculture and agri-foods sector designed to help position Canada as a world leader in agriculture and agri-foods.

A quick review of current renewable energy techniques already being employed by farmers in NL has revealed that a handful of growers are using wood pellet burners to heat their greenhouses. The Organic Farm in Portugal Cove is using geothermal technology. New World Dairy has an anaerobic digester and number of farmers are looking into the potential of using biogas technology. The Newfoundland and Labrador Federation of Agriculture has recently commissioned a feasibility study on the use of biogas(29). Information gleaned from the interviews conducted for this report revealed that while wind energy is appealing there is a lack of support in this province due to the fact that excess energy produced by the turbine will not be bought back by the province (an essential condition for making this technology sustainable in other locations throughout the world).

An important factor that can limit the adoption of new technologies in NL is the lack of expertise at an institutional level. NL does not have agricultural university. Importantly in the last few years there have been some changes to this situation, maybe partly due to the fact that the current Dean of Memorial has an agriculture background. Another positive development is the fact that Growing Forward 2 is offering funding to help graduate students. This year (2014) is the first of 5 years of this program. The producers interviewed in this study were very pleased with the amount of support they received from the Department of Natural Resources however in informal talks with people from that department I learned that the department has experienced problems (due to cutbacks) with having the capacity to follow up and facilitate the sharing of technologies. This means that producers often learning through word of mouth, a process that can be slow and can lead to misinterpretations.

The table below contains description of the most commonly found renewable technologies.

Table 6: Description of Common Renewable Technologies.

Waste Vegetable Oil	<p>Use waste vegetable oil as a fuel to heat greenhouse with a waste oil furnace (www.cleanburn.com). Some issues to consider with this technology is that</p> <ul style="list-style-type: none"> • The furnaces require frequent maintenance to keep them running consistently: clogging on the inside of the burner results from the “shellac” that forms from the waste vegetable oil • The collection of the waste oil requires additional labor and management. • Savings would be greater when traditional fuel prices are higher • The additional cost of the waste oil furnace also has to be considered and amortized over the lifetime of the furnace, but the payback is quick(31)
Wind Power	<p>As noted above, net metering means that a farm can send electricity to the grid when they are generating more than their demand, then pull electricity back off the grid when generating below their demand. Net metering makes most on-farm electricity projects more attractive to pursue</p> <ul style="list-style-type: none"> • Need to consider performance of turbine and current electricity price • Tree of Life Sustainability Project Inc. on Salmonier Line for local context, they are generating electricity with a wind turbine(32).
Wood Pellet Furnace	<p>This technology is being adopted by greenhouse growers because the pellets burns efficiently.</p> <ul style="list-style-type: none"> • The price of wood pellets has been volatile in recent years • Used by Bickerstaff Nurseries and Woodland Nurseries • The Department of Natural Resources in currently drafting a report on the use of wood pellets in the province

Solar Hot Water

Most solar water heating systems for buildings have two main parts: a solar collector and a storage tank. The most common collector is called a flat-plate collector. Mounted on the roof, it consists of a thin, flat, rectangular box with a transparent cover that faces the sun. Small tubes run through the box and carry the fluid — either water or other fluid, such as an antifreeze solution — to be heated. The tubes are attached to an absorber plate, which is painted black to absorb the heat. As heat builds up in the collector, it heats the fluid passing through the tubes. The storage tank then holds the hot liquid. It can be just a modified water heater, but it is usually larger and very well-insulated. Systems that use fluids other than water usually heat the water by passing it through a coil of tubing in the tank, which is full of hot fluid. Solar water heating systems can be either active or passive, but the most common are active systems. Active systems rely on pumps to move the liquid between the collector and the storage tank, while passive systems rely on gravity and the tendency for water to naturally circulate as it is heated.

- A good system design has the tank integrated into the envelope of the greenhouse so that “tank losses” become “greenhouse heat.” (21)

Geothermal

Geothermal reservoirs of hot water, which are found a few miles or more beneath the Earth's surface, can be used to provide heat directly. This is called the direct use of geothermal energy. In modern direct-use systems, a well is drilled into a geothermal reservoir to provide a steady stream of hot water. The water is brought up through the well, and a mechanical system—piping, a heat exchanger, and controls—delivers the heat directly for its intended use. A disposal system then either injects the cooled water underground or disposes of it on the surface

- Geothermal heat pump systems consist of three parts: the ground heat exchanger, the heat pump unit, and the air delivery system (ductwork). The heat exchanger is a system of pipes called a loop, which is buried in the

shallow ground near the building. A fluid (usually water or a mixture of water and antifreeze) circulates through the pipes to absorb or relinquish heat within the ground. Heat pumps work much like refrigerators, which make a cool place (the inside of the refrigerator) cooler by transferring heat to a relatively warm place (the surrounding room), making it warmer. In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system, moving heat from the ground to the building's interior. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger, effectively moving the heat from indoors to the ground. The heat removed from the indoor air during the summer can also be used to heat water, providing a free source of hot water. Geothermal heat pumps use much less energy than conventional heating systems, since they draw heat from the ground. They are also more efficient when cooling your home. Not only does this save energy and money, it reduces air pollution (19).

Solar Cells

Solar cells, also called photovoltaic (PV) cells by scientists, convert sunlight directly into electricity. PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the PV effect (33)

Biogas

The following information comes from the recent feasibility study on Biogas commissioned by the Newfoundland and Labrador Federation of Agriculture. Biogas is the product of a biological process known as anaerobic digestion. In the absence of oxygen, anaerobic bacteria decompose organic matter and produce biogas, which is primarily composed of methane (60%) and carbon dioxide (40%). By comparison, natural gas is roughly 95 - 99% methane.

- An analysis of the available farm based feedstocks identifies dairy farms, poultry farms and mink farms as the most likely
-

candidates of biogas projects.

- As a result of being on an island, Newfoundland's import of fertilizer and agricultural goods, including animal feed, is more expensive than in other parts of Canada. This expense is a significant competitive disadvantage, particularly with the high-cost import of fertilizers. In addition the province is facing increasing challenges with the safe and environmentally sustainable management of organic waste products.
- The Avalon region has the greatest potential for biogas project development, as there are major source of dairy, poultry and mink manure available in the area
- Fish waste from wild fisheries and aquaculture are good co-substrates for anaerobic digestion

The Lettuce Farm

This is a local producer (currently not producing as they are moving locations) who employs a number of unique technologies.

- Hydroponic lettuce production(34-36)
 - Light system which captures natural light and re-directs it into a light pipe system which will illuminate a vertical farm
 - Also working on a series of natural light and LED lighting trials
-

Season Extension Technologies

The use of season extension technologies such as high tunnels and greenhouses are an important technology for NL farmers to consider. The statistics on current greenhouse production included in Section 1 of this report reveal that greenhouses are currently not a widely used technology for vegetable growers. The interviews with producers in the Avalon region reveal a trend that does not appear in statistics that some “niche” farmers are noticing positive results from the expanded use of greenhouses. An issue for farmers in NL are the heavy winds, which producers reported in the interviews above are becoming increasingly severe. This issue and others were explored in a recent provincial conference put off by the Department of Natural Resources and the NL(37). There are a number of online resources about season extension(38-40). Also the

following sites contain calculators that help producers compare the costs and benefits of introducing new crops or technologies(41-43).

Alternative Marketing Strategies

In addition to the use of renewable resources and season extension technologies, farmers in NL could benefit from the adoption of alternative marketing strategies. This fact has been alluded to above both from the summarized marketing reports and from the interviews. There appears to be a growing market for alternative markets and these give farmers flexibility outside the traditional wholesaler-retailer system and its constraints for the small-scale farmer. Firstly farmers' markets have the potential to be instrumental in supporting the local food system (44). The St. John's Farmer's Market has been growing steadily for the past 5 years (<http://stjohnsfarmersmarket.org/about-us/>) and a recent Harris Centre report details the potential and challenges of farmers' market development for the western region and ways forward to develop and improve the market (5).

Another interesting marketing model being explored in the U.S., is the food hub. Food hubs, or regional food aggregation and coordination facilities, offer great promise for systemic social and environmental change. There is a growing interest in food hubs as a route to alleviating food deserts, increasing small farm viability, establishing much needed infrastructure, providing fresh and low-carbon footprint food to all communities, and revitalizing local economies. Food hubs allow farmers to work together to be able to provide larger amounts of product on a more consistent basis, and to store products (aggregation of distribution and facilities) for regional systems (26, 45, 46).

Two unique alternative marketing strategies for farmers follow. In the first, farmers are paid for their "ecosystem services" (47). Ecosystem Services include such things as creating wildlife habitats for resident and transient wildlife populations; providing opportunities for recreational activities; providing opportunities for enhancing the soil system, promoting organic matter buildup/carbon sequestration, and preventing disturbances; promoting biodiversity, etc. Finally, the Farmery is a prototype farm/market where farmers grow and sell at the same site. This system is created from shipping containers and modular greenhouse components. Living wall panels hang off outside of the shipping containers and are enclosed in a greenhouse. Aquaponic crops grow on these panels and inside the shipping containers, gourmet mushrooms are grown. This system is 50% aquaponic and 50% hydroponic and is focused on strawberries, greens, and herbs. This is a new retail experience as customers can see the crops grow and help harvest them(48).

Pending Tasks

This environmental scan took place from January 2014-March 2014. A number of pending tasks could be fulfilled in a longer timeline to make this scan more complete.

Pending Tasks:

1. Gather statistics which represent small-scale agricultural and marketing trends in NL.
2. Link pricing data with transportation disruptions (due to weather or ferry service)
3. Engage in comprehensive interviews with all producers in NL employing innovative technologies.
4. Complete cost comparisons for the adoption of a range of technologies and varying scales of implementation (small-, medium- and large-scale adoption).

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Appendices

Appendix A: Taken from page 23 of “Wholesale and Other Opportunities in the Vegetable Industry of NL” (8).

Table 18: Summary of the Currently Supplied Vegetables for the Wholesale Industry.			
	Amount Supplied (lbs)	Required Acres	Estimated Value
Beet	17,374	2	\$8,513
Broccoli	241,635	27	\$115,985
Cabbage	665,742	38	\$219,695
Carrot	523,625	43	\$188,505
Cauliflower	56,860	5	\$21,038
Celery	12,936	0.6	\$12,160
Corn	76,072	8	\$30,429
Lettuce - Head (Iceberg)	59,466	4	\$33,896
Lettuce - Romaine	58,410	4	\$27,453
Onion - Green	6,719	0.4	\$13,908
Onion - Yellow	112,500	8	\$42,750
Parsnip	48,940	6	\$62,154
Potato - All Varieties	1,952,223	109	\$566,145
Rutabaga (Turnip)	1,089,411	61	\$457,553
Tomato - Field	39,274	4	\$15,710
TOTAL	4,961,187	320	\$1,815,892



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