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Research Brief

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Economic Impacts of a Regionalized Food System in the Okanagan Bioregion

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Abstract

This study examined the economic impacts of food system regionalization in the Okanagan bioregion. It is the second study of its kind. The first study developed the methodology and applied it to the Southwest region of British Columbia (BC). We employed the same methodology in the context of the Okanagan bioregion estimating the economic impact using the novel ISFS food self-reliance model and the Regional Input-Output model for BC. The economic impacts were analyzed within a framework of different hypothetical future scenarios in 2050 compared to the baseline year 2016. Each scenario highlighted outcomes of different approaches to the regionalization of the food system. The results revealed that growing foods that best satisfy local food need, increasing food processing and increasing purchases of local food lead to higher economic impacts. Additionally, in the Okanagan bioregion there is potential to achieve these economic benefits while maintaining important fruit exports (apples, sweet cherries and wine grapes). The results are not predictive but can be used to compare the outcomes and trade-offs of food system decisions for the Okanagan bioregion.

Background

As more individuals become aware of the weaknesses and externalities of our current food system, calls for an alternative food system have been increasing. Studies conducted in British Columbia (BC) reveal that residents are highly interested in supporting a local/regional food system through their purchases of local food (BC Stats, 2018, Polasub et.al, 2020, Wijekoon, et.al, 2020). Federal, provincial and local governments have been increasingly responsive to this interest, creating food system policy and adopting food system plans (Hansen et. al., 2021).

"As much food as possible to meet the population's food needs is produced, processed, distributed, and purchased at multiple levels and scales within the region, resulting in maximum resilience, minimum importation, and significant economic and social return to all stakeholders in the region" (Clancy and Ruhf, 2015).

With the growing interest in local food systems, there is increasing desire to understand associated economic impacts (O'hara and Pirog, 2013). One way of looking at economic growth potential is through an economic impact assessment (EIA) (Goldenberg and Colasanti, 2017). EIA aims to quantify the impact of a specific change on the local economy. EIAs may also be used to pose future 'what if' scenarios by estimating the impact of a hypothetical change. Input-output (I-O) models are the most common approach to economic impact assessments (Shideler and Watson, 2019, Goldenberg and Colasanti, 2017, McFadden et. al 2016, O'Hara and Pirog 2013).

To understand how regionalization affects economic performance of the food system, we followed the concept of regionalization as defined by Clancy and Ruhf (2015): that an ideal regional food system is one in which:

"As much food as possible to meet the population's food needs is produced, processed, distributed, and purchased at multiple levels and scales within the region, resulting in maximum resilience, minimum importation, and significant economic and social return to all stakeholders in the region".

Adopting this definition of regionalization and using the 'What if' scenario analysis method of estimating economic impacts, in a previous study, we explored the economic outcomes of food system regionalization for the Southwest BC Bioregion. We used a novel food self-reliance computational model, developed by the Institute for Sustainable Food Systems (ISFS) and the British Columbia Input-Output model (BCIOM) by BC Stats to quantify the economic impacts. That study concluded that the ability to produce food regionally, create value added products (process food) and the willingness of the local population to consume local food could be central to the economic vitality of the Southwest BC Bioregion (Polasub et.al, 2016).

With this Okanagan bioregion study, we add to the literature by further exploring these conclusions. We examined the economic impacts of food system regionalization in the context of the Okanagan bioregion (Robert, et. al, 2019). In addition, we also examined the impacts of food processing and local food purchases on the economy.

Methods

Our study focus was the Okanagan bioregion, which comprises three contiguous regional districts of the Okanagan (North Okanagan, Central Okanagan, and Okanagan - Similkameen). The bioregion is defined by common ecological character and human culture (Harris et.al., 2016).

Food Systems Scenarios and Modeling

The economic impact of food production in the Okanagan bioregion was estimated using different hypothetical future scenarios for 2050 for comparison to the baseline year 2016. Each scenario highlighted outcomes of different approaches to the regionalization of the food system.

We used the ISFS food self-reliance model, comprised of two computational models developed by the ISFS (Dorward, Smukler, and Mullinix 2017, 2016), to estimate current (2016) and future (2050) food production, food self-reliance[1], environmental impacts, and economic outcomes

for different food system scenarios. The two models, based on agricultural land use allocation, employ different calculation techniques. In the Spreadsheet Model, future agricultural land use allocation follows 2016 agricultural land use patterns for the Agricultural Land Reserve (ALR) lands in the bioregion[2]. In the Optimization Model, future agricultural land use is reallocated and prioritized to meet food need[3] in the Okanagan, with maximizing Okanagan food self-reliance as a goal. As a result, in this model, land is allocated to foods that satisfy the highest level of local food need possible. Both models assumed that bioregional consumers choose to purchase locally produced food whenever available (that is, locally produced food is first sold to the local market, and food produced in excess is exported). When regional production cannot satisfy regional demand, importation of that food is necessary. Each scenario considered all food commodities consumed by the Okanagan bioregion's population. With these computational models, the following seven food system scenarios were generated for comparison.

The Food System 2016 scenario uses available statistical data from 2016 to model conditions that most closely align with the existing food system in the Okanagan bioregion. Approximately 40,000 hectares of land are under cultivation in the bioregion. Since the spreadsheet and optimization models assume that the bioregion's population chooses to consume local food over imports, the estimated amount of food produced for local consumption in this scenario is likely to be greater and the amount of food imported is likely to be smaller than what actually occurred in 2016.

The Business as Usual (BAU) scenario, explores a year 2050 food system when population increases by 43% which also increases the associated food need commensurately. However, there are no changes to the land under production, types or quantities of crops and livestock produced in the bioregion, food production practices, or crop and livestock yields, compared to the Food System 2016 scenario. In other words, the food system remains the same as it was in 2016.

In the Farmland Loss scenario, farmers in the Okanagan bioregion continue to produce the same crop and livestock mix as in the BAU scenario. Measures to protect and ensure the productive use of farmland are not prioritized, resulting in a 20% (8,000 hectares) reduction in the land area available to produce food in 2050, relative to the 2016 scenario.

The Regionalized Food Production scenario explores a different future in which we move toward a food system that produces food that best meets local food need and maximizes food self-reliance. The goal of this scenario is first and foremost to satisfy the dietary needs and preferences of the local population. The food system becomes increasingly regionalized. In the regionalized food production scenario and subsequent scenarios, we make several assumptions. First, we assume that consumers choose to purchase local products over imported products, and producers aim to produce and process the types of food that would satisfy local food need. Second, feed grain for livestock is not produced in the bioregion but imported. Third, the bioregion has developed processing capacity so that it can process all food requiring post-production within the bioregion itself. In this scenario, the land base available for food production remains the same as in 2016.

The Maintain Export Production scenario examines the economic outcomes of maintaining the export of apple, sweet cherry and wine grape; all economically and culturally important in the Okanagan bioregion. In the regionalized food system scenario, the reallocation of crop and livestock production to best satisfy food need results in a significant contraction of this export-oriented sector, decreasing these fruit crops by 1,453 ha and producing only what is required to meet local food need. This scenario explores the outcomes of a regionalized food system if apple, sweet cherry and wine grape production is maintained per 2016 production levels.

The Expand Land for Food Production scenario examines the economic outcomes of expanding the land base used for food production. Scenarios based on 2016 agricultural land utilize only a portion of the Okanagan's agricultural land base that could be used for food production. In this scenario, we explore the outcomes of expanding farming to all land suitable for food production while considering access to water. The agricultural land base in production increases by approximately 30,000 ha (a 75% increase), bringing the total land available for food production to 70,000 ha.

The Mitigate Habitat Impacts scenario builds on the expand land for food production scenario. It represents a future where we take measures to mitigate some of the negative impacts associated with agriculture by protecting critical habitat areas and by establishing hedgerows and riparian buffers throughout the agricultural land base. When protection and enhancement of habitat in the agricultural landscape is prioritized 13,000 ha (20%) of land is removed from the 70,000 ha of land available for food production in the expand land scenario.

These hypothetical scenarios paint a picture of various possibilities for the Okanagan bioregion's future food system. However, it does not mean these are our only options. The scenarios are meant for illustrative purposes to help motivate and inform discussion about the type of food system we would like to have, and the decisions we might need to make now to achieve that goal. The seven food system scenarios and their assumptions are summarized in Table 1.

Table 1: Summary of theoretical food system scenarios modeled in the Okanagan Bioregion Food System Design Project and reported in this brief

Scenario	Type of model	Regional focus	Population (# of people)	Farmland modelled (hectares)	Food Need (tonnes)	Processing capacity	Export sector	Habitat mitigation
2016 Food System	Spreadsheet	No	360,000	40,000	330,000	2016	Yes	None
2050 Business as Usual	Spreadsheet	No	520,000	40,000	480,000	2016	Yes	None
2050 Farmland loss	Spreadsheet	No	520,000	32,000	480,000	2016	Yes	None
2050 Regionalized Food Production	Optimization	YES	520,000	40,000	480,000	Increases as necessary	No	None
2050 Maintain Export Production	Optimization	YES	520,000	40,000	480,000	Increases as necessary	Yes	None
2050 Expand Land for Food Production	Optimization	YES	520,000	70,000	480,000	Increases as necessary	No	None
2050 Mitigate Habitat Impacts	Optimization	YES	520,000	57,000	480,000	Increases as necessary	No	Yes

Economic Impact Estimation

The Regional Input-Output model of British Columbia[4] (I-O Model) was used to estimate the economic impacts of the Okanagan bioregion's food production on the Okanagan bioregion's economy. Food production industries considered in this study consisted of those in the primary agriculture and food processing sectors. These industries are defined using the North American Industry Classification System (NAICS) as given by Statistics Canada (2020j).

Primary agriculture sectors included:

- Crop production (NAICS code 111) and
- Animal production (NAICS code 112)[5].

Food processing sectors included

- Grain and oilseed milling (NAICS code 3112)
- Fruit and vegetable preserving and specialty food manufacturing (NAICS code 3114)
- Dairy product manufacturing (NAICS code 3115) and
- Meat product manufacturing (NAICS code 3116).

I-O models estimate the impacts of a change in an economic activity on a national or regional economy (Goldenberg and Colasanti, 2017). The I-O model used in this study also provides information on the flow of goods and services and inter-industry linkages of all sectors of the economy (BC stats, 2016). The model is based on 2016 data derived from interprovincial input-output tables developed by Statistics Canada. The model assumes that there are no capacity constraints to increase production and that an increase in demand for labour for example, will increase employment which can be fulfilled by the population. Moreover, the I-O model assumes a static environment, estimating the economic impacts from modelled activities in 2016 dollars. Therefore, the economic results are not predictive but can be used to compare across scenarios, assuming similar economic conditions to the year 2016.

The I-O Model reports three types of economic impacts according to their sources: direct, indirect and induced. Indicators that report "total" economic impacts measure the sum of direct, indirect, and induced impacts.

- D**irect impact** measures the economic activity in the Okanagan bioregion generated by the bioregional food production (raw and processed) in the NAIC industries mentioned above.
- **Indirect impact** measures economic activities in the Okanagan bioregion generated by supplier industries in the food production supply chain. For example, for crop production, the supplier industries include industries that supply fertilizers, pesticides, transport, fuel, repair and construction, electricity and support services such as farm accounting, soil amendment, fertilizer application, labour, etc.
- **Induced impact** measures the economic activity in the Okanagan bioregion that results from food production and supplier industry employees spending their earnings in the Okanagan bioregion. For example, spending on housing, food, telecommunication, vehicles, utilities, banking and other financial services, etc.

Key indicators used to quantify economic impacts are output, gross domestic product (GDP), employment, employment income, and tax revenue. Each indicator is described below.

- **Output** is the value of the final goods and services including the value of their intermediate inputs. However, the value of intermediate inputs gets counted every time they change hands, causing double counting of the value of those inputs. This is an indication of the flow of goods and services within the economy as well as the linkages between different industries in the economy.
- **GDP** is the unduplicated total value of the goods and services. GDP reflects the difference between the value of final products or services and the value of the input or intermediate costs of production. GDP does not double count the values of intermediate inputs. Therefore, GDP is smaller than the value of the output. GDP is calculated at "basic price". That is, using the prices received by producers as opposed to the prices paid by consumers. GDP is a useful indicator as it is a uniform measurement of the growth and productivity of the economy that can be compared across regions and countries and between periods of time.
- **Employment** measures the total number of jobs required to support all industries affected by production of food in the Okanagan bioregion. The total number of jobs includes seasonal/temporary, year-round, part-time and full-time positions. The employment indicator can also be conveyed by the number of full-time equivalent (FTE) jobs. One FTE assumes that a person works 35 hours per week for 50 weeks a year (or 1,750 hours annually). When the reported FTE is higher than the number of jobs, it implies that a typical worker in the industry works more than 1,750 hours annually.
- **Employment Income** measures income earned by workers in all industries affected by the production of food in the Okanagan bioregion. This includes income earned by self-employed individuals and unincorporated businesses. Income is an important economic indicator as it is a determinant of participation (consumer spending capacity) in the economy by income earners.

- Tax Revenue refers to federal, provincial and municipal tax revenue collected through all production activities. Provincial and federal taxes include personal income tax, corporation income tax, taxes on products and taxes on factors of production. Municipal tax includes tax on products and on production such as tax on accommodation, business, licenses, permits, fees and property tax.

Results and Discussion

In order to estimate economic impacts, we first calculated the value of raw food commodities (crop and livestock) by multiplying the total tonnes of production (calculated by the ISFS Food Self-Reliance model) with the average annual farm gate price from Statistics Canada (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g)[6]. The value of an import product is calculated by multiplying the total tonnes of import (calculated by the ISFS food self-reliance models) with the average annual import price obtained through the Canadian International Merchandise Trade database (Statistics Canada, 2020h).

The ISFS food self-reliance model also estimates the quantity of crop and livestock products that were consumed as processed products (such as fruit juice, frozen vegetables and dairy) based on the regional food need and food preferences. One hundred and twenty-one types of food were included in this calculation. Detailed results on food self-reliance capacity of the Okanagan bioregion can be found in Polasub et. al., 2020.

With information on value of raw food commodities in the Okanagan bioregion, the I-O model was able to calculate the total value of raw and processed food products. This value was then used in the I-O model to quantify the economic impacts of food production (raw and processed) for the Okanagan bioregion. The estimated quantities and values of food production, food imports, and food exports are presented in Table 2. The estimated economic impacts of food production calculated by the Regional I-O model of BC is reported in Table 3.

Estimating the Economic Impacts Using Scenario Analysis

2016 Food System scenario

The 2016 Food System scenario serves as a baseline and uses available data from 2016 to model conditions close to the existing food system in the Okanagan bioregion. In 2016 the bioregion produces 236,000 tonnes of food on 40,000 ha of agriculture land (Table 2). Assuming that residents choose locally produced food over imports, the Okanagan bioregion sells 46% (109,000 tonnes) of product to the local market and 54% (128,000 tonnes) to the export market. This represents an export-oriented food production system. Since all food need cannot be met locally, the bioregion imports 223,000 tonnes of food valued at $280 million.

According to I-O model estimates (Table 3), food production and related goods and services in the Okanagan bioregion generated $349 million in total output and $134 million in total GDP. Of the total GDP impact, food production (raw and processed) contributes $112 million directly (direct GDP)[7], all supplier industries in the food production supply chain contribute $20 million indirectly (indirect GDP), and employees in all related industries contribute $2 million (induced GDP) by spending their earnings in the Okanagan bioregion. Primary agriculture (crop and livestock) sectors contribute 74% to total GDP impact, food processing 21% and all other industries 5%.

Food production and related goods and services in the Okanagan bioregion create 2,300 full time equivalent (FTE) jobs (Table 3). The highest proportion (83%) of FTE jobs are in primary agriculture followed by 14% in food processing, and 3% in other related industries.

Total employment income earned through wages and salaries from food production and related goods and services is $84 million (Table 3). Of this, employees in the primary agriculture sector earn $60 million, employees in food processing earn $20 million and employees from other

industries earn $4 million. As an industry total, primary sector employees earn the most overall, however, this is driven by the large number of employees in this sector, not necessarily wage. According to our I-O model estimates, the average annual earning per employee in the primary agriculture sector is $27,000, which is substantially lower than the food processing sector's average annual earnings of $48,000 per employee.

A total tax revenue of $17 million was generated by food production and related goods and services (Table 3). Of this, $9 million was distributed to the federal government, $5 million to the provincial government and $3 million to local governments.

Table 2: Estimated quantities (tonnes), values ($ million, in 2016 dollar value) of food production, food imports and food exports from the food production sector in the Okanagan bioregion, by scenario

	2016 Food system	Business as Usual (BAU)	Farmland Loss	Regionalized Food Production	Maintain Export Production	Expand Land for Food Production	Mitigate Habitat Impacts
Total production (tonnes)	236,000	236,000	189,000	302,000	373,000	361,000	361,000
Total production (raw) ($)	269	269	215	291	425	343	329
Total production (raw and processed) ($)	338	349	294	466	587	529	512
Imports (tonnes)	223,000	362,000	380,000	177,000	215,000	118,000	118,000
Imports ($)	280	446	466	268	299	230	233
Exports (tonnes)	128,000	119,000	90,000	0	109,000	0	0
Exports ($)	156	149	115	0	138	0	0
For Okanagan markets (tonnes)	109,000	117,000	98,000	302,000	264,000	361,000	361,000
For Okanagan markets ($)	113	120	100	291	287	343	329

Table 3: Summary of all total economic impacts ($ million) from the food production sector in the Okanagan bioregion, by scenario

	2016 Food system	Business as Usual (BAU)	Farmland Loss	Regionalized Food Production	Maintain Export Production	Expand Land for Food Production	Mitigate Habitat Impacts
Total output ($M)	349	360	309	481	607	545	528
Total GDP ($M)	134	137	113	147	217	166	158
Total employment income ($M)	84	87	72	101	142	113	108
Total tax revenue ($M)	17	18	15	19	28	21	21
Total employment (FTE)	2,300	2,300	1,900	2,200	3,600	2,500	2,400

Note: The total economic impacts include direct, indirect and induced impacts. Detailed impacts are in the Appendices A through E.

Business as Usual (BAU) Scenario

The BAU scenario examines a 2050 future where population increases by 43% however the food system remains as it was in 2016. With increased food need, food import expenditures increase by 59% up to $446 million and the bioregion becomes more reliant on imports to feed the population (Table 2). Imports represent a "leakage" of local money out of the Okanagan bioregion. In this context, the leakage can be viewed as a loss of economic activity and associated benefits that could have been realized if Okanagan farmers had produced the food being imported within the bioregion itself.

Since total food production in the bioregion remains the same (236,000 tonnes), the economic impacts for the BAU scenario is similar to the 2016 food system scenario (Table 3). However, as a result of increased food need, 8,000 tonnes of food that were previously exported now remains in the bioregion for local consumption. A portion of this food will be processed and therefore the total value of food (raw and processed) increases by 3%. As a result, total output, GDP, employment income impacts, and number of FTE increases slightly compared to the 2016 scenario.

Farmland Loss Sscenario

There is a direct correlation between agriculture land area and the amount of food produced. When agriculture land is reduced in the Land Loss scenario, total food production (tonnes) also decreases. Imported food expenditures (economic leakage) rises even further to $466 million, which is the highest among all scenarios (Table 2).

With decreased food production, economic impacts will decrease even further (Table 3). Compared to the BAU scenario, total output impacts decrease by 14% to $360 million and total GDP impacts decrease by 18% to $113 million. Similarly, total employment income, total tax revenue impacts and the number of jobs (FTEs), decreased by 17%, 17% and 19%, respectively.

Regionalized Food Production Scenario

When the food system moves toward a more regionalized food system by producing foods that best satisfy local food need, land that was previously devoted to exports (crops or livestock) is now reallocated to food production to prioritize satisfying bioregional food need. As a result, total food production (tonnes) increases by 28%, even though the amount of farmable land in production stays the same as the BAU scenario (Table 2). Since all food produced is consumed locally, there is no food left for the export markets. Expenditure on food imports decreases to $268 million (Table 2).

In the regionalized food system, the amount of food processing increases to better meet bioregional food needs. For example, (data not shown in the tables) the value of vegetables processed increased from $0.3 million in the BAU scenario to $9.6 million in the regionalized scenario. Moreover, in the regionalized food system scenario (and subsequent scenarios with a regionalized food system), it is assumed that all food that requires processing can be processed within the bioregion itself. As a result, the value of food production (raw and processed) increases by 34% (or $117 million) compared to the BAU scenario (Table 2).

In the regionalized food system scenario, total output increases by 33% and total GDP by 7%. Total employment income and total tax revenue increase by 16% and 8% respectively compared to the BAU scenario (Table 3). Nevertheless, the number of FTEs generated declines slightly. This is primarily due to the decrease in labour intensive production sectors such as tree fruit, and an increase in food processing which tends to be mechanized, requiring less labor.

Maintain Export Production Scenario

In the Regionalized Food System scenario, the reallocation of crop and livestock production to best meet food need results in a significant contraction of the export-oriented fruit industry in the Okanagan bioregion. In this scenario, we explore the economic outcomes of maintaining fruit exports, and wine and other beverage production in a regionalized food system.

When the production of major fruits is maintained at 2016 production levels, total food exports rise from $0 to $138 million and expenditure on food imports rises by 12% (to $299 million) to accommodate decreased food production for local markets (Table 2). Total output impacts increase by 48% compared to the Regionalized Food System scenario (Table 3). Total GDP impacts, total employment income and total tax revenue increases by 48%, 41% and 48% respectively. The number of FTE jobs increase to 3,600 highlighting the significant labor requirements of these sectors. Maintaining the three major fruit export industries within a regionalized food system generates the highest economic impacts out of all scenarios. However, it comes at a cost of food self-reliance, which decreases by 3 percentage points (from 69% to 66%). In the Okanagan, the fruit and wine grape sectors require an influx of seasonal labour during the growing season, much of which is currently provided by an estimated 6,000 temporary foreign workers, and another 1,500 transient workers from elsewhere in Canada (Glen Lucas, e-mail communication, November, 24, 2020). The COVID-19 pandemic sheds light on the dependence of the fruit production sector in the Okanagan bioregion on foreign labour as a possible vulnerability.

Expand Land for Food Production Scenario

In the Expand Land for Food Production scenario, food production is expanded to all land suitable for agriculture. This increases food production to 361,000 tonnes (Table 2). The value of food production (raw and processed) increases to $529 million. In this scenario, food imports are minimized at $230 million.

Increased food production leads to higher economic impacts (Table 3) and less economic leakage. Compared to the Regionalized Food System scenario, total output impacts and total GDP impacts both increase by 13%. Total employment income, total tax revenue and the number of FTEs increases by 12%, 7% and 12%, respectively. Nevertheless, the total food production (raw and processed) and related economic impacts are lower than if export fruit production were maintained. This demonstrates the economic value of the major fruit sectors (apple, sweet cherry, wine grape) in the Okanagan bioregion, and suggests that in the Okanagan bioregion a robust regionalized food system and significant export oriented agriculture sector are both achievable, and together offer the greatest economic benefit.

Mitigate Habitat Impacts Scenario

The previous scenario demonstrated that the Okanagan could reach a higher food self-reliance level and realize increased economic impacts by utilizing lands that are suitable, but not currently used, for food production. However, while economic outcomes improve in that scenario, environmental indicators measuring the quality of wildlife habitat[8] are negatively impacted. In this scenario, we examine the economic outcomes of prioritizing habitat protection and enhancement while expanding land for food production in the bioregion. Implementing habitat protection measures reduces the agricultural land base available for food production by 14,000 hectares (20%) from 70,000 ha land available for food production in the Expand Land for Food Production scenario.

Less agriculture land decreases food production by 18% to 296,000 tonnes compared to the Expand Land for Food Production scenario (Table 2). Total output decreases by 3% and total GDP impacts by 5% (Table 3). Total employment income, total tax revenue and the number of FTEs decreases by 4%, 1% and 5% respectively. This indicates there is a trade-off between environmental stewardship measures we have modeled and economic impacts.

Economic Impacts by Sector

Various food system sectors contributes differently to the economy. This analysis looks at the economic impacts by three major food system sectors:

- Primary agriculture sector including crop, greenhouse and animal production;
- Food processing sector including fruit, vegetable, dairy and meat processing; and
- Other industries contributing to food production such as transportation, warehousing and wholesale trade.

Per Figures 1, in the scenarios that represent the current food system (2016 Food System scenario, Business as Usual (BAU) scenario, Farmland Loss scenario), the primary agriculture sector contributes larger economic impacts compared to the food processing sector. The large primary agriculture sector represents the sizable export-oriented tree fruit and wine grape sector in the Okanagan.

In contrast, in the scenarios with regionalized food systems with no exports (Regionalized Food System scenario, Expand Land for Food Production scenario, Mitigate Habitat Impacts scenario) the food processing sector plays a more important role. The economic impacts from the food processing sector in term of total output, GDP, employment income and tax revenue rises above the impacts generated by the primary agriculture sector (Figure 1). In these scenarios, there are no exports, therefore, tree fruit and wine grape production are only limited to the needs of the local market and which substantially decreases the size of the primary agriculture sector. Moreover, in the regionalized food system, food processing capacity increases to meet population's demand. As more food is processed in the bioregion, the food processing sector generates more economic activity resulting in higher output, GDP and employment income and tax revenue impacts.

When the export sector is maintained (Maintain Export Production scenario), primary agriculture once again dominates and generates higher economic impacts compared to the food processing sector. In terms of number of FTE generated, the primary agriculture sector generates a larger number of FTE in all scenarios. This is because primary agriculture sector is labor intensive, compared to the food processing sector.

This analysis reveals that the sectoral contribution is influenced by the export-oriented apple, sweet cherry and wine grape sectors in the Okanagan bioregion. This is further confirmation of the significant economic contribution of these sectors.

Other Findings

All scenarios were constructed based on the Regional I-O model of BC that share the same assumptions such as input costs including wages, tax structure, consumer spending, inter-industry linkages and imports of supplier industries. Therefore, there are some characteristics common to all scenarios.

First, the number of FTEs in the primary agriculture sectors were consistently lower than the total number of jobs. This implies that an average worker in the primary agriculture sector worked less than 1750 hours annually (i.e. full time). This is not surprising since the agriculture sector in the Okanagan bioregion hires many seasonal workers who only work during the growing season. In comparison, for all food processing sectors the FTE is higher than the total number of jobs implying that an average worker in food processing works more than 1750 hours annually (or on an average 35+ hours per week). According to Statistics Canada (2020i), the average weekly hours for an employee paid by the hour in the manufacturing industry in BC is the 36.2 hours per week.

Second an estimated average annual income of an employee in the primary agriculture sector was lower compared to an employee in the food processing sector or other related industries (such as wholesale trade, transportation, utilities, etc.). In all scenarios, the average earning of a

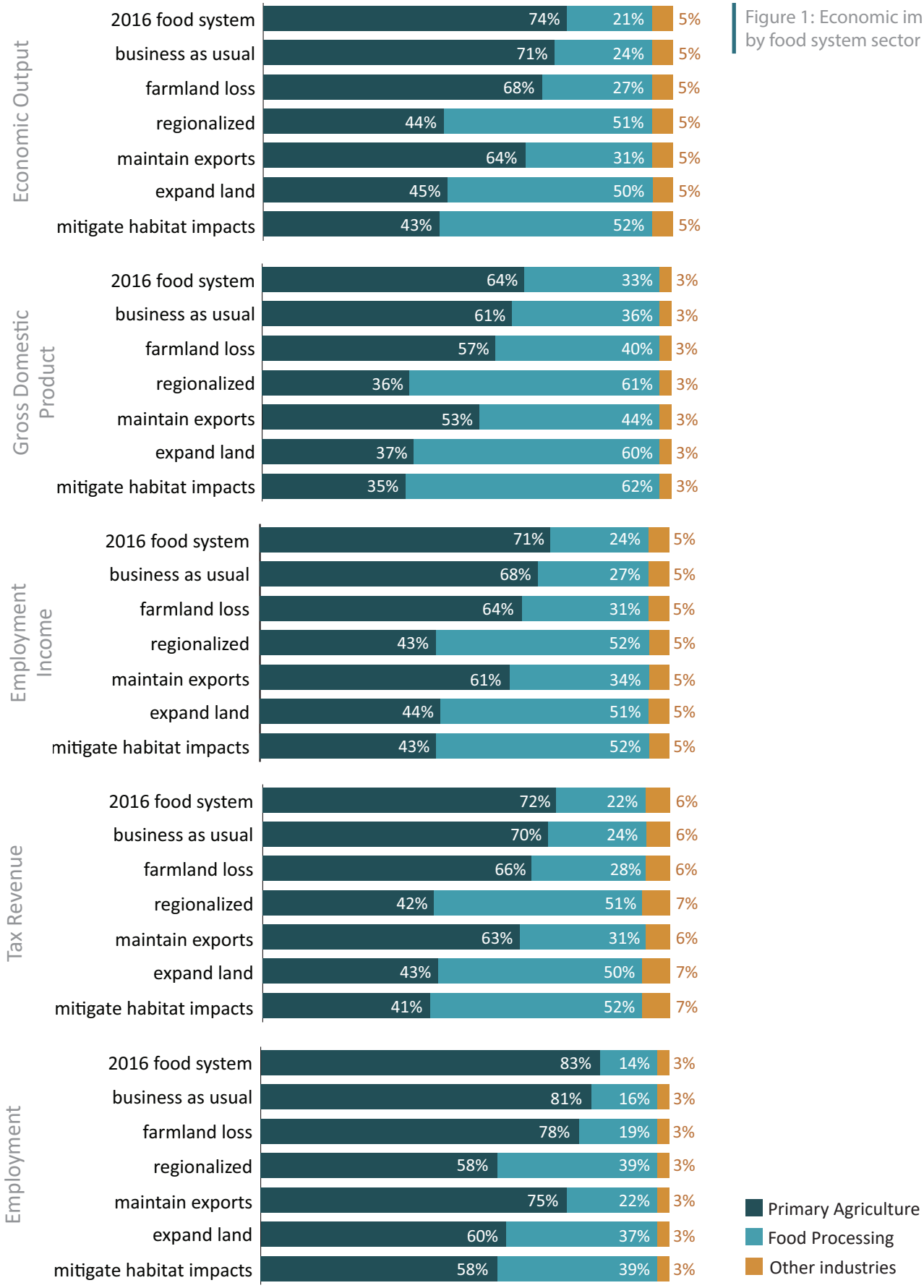

Figure 1: Economic impacts by food system sector

primary sector worker was estimated at $27,000, while the average earnings of an employee in the food processing sector ranged from $47,000 to $48,000. This is not an uncommon trend in our economy.

The Economic Impacts of Food Processing in the Okanagan

All regionalized food system scenarios assume that necessary processing capacity exists to process food such as fruits, vegetables, grains, dairy and meats. What if the region did not develop its processing capacity beyond what currently exists? Such comparison reveals that there are substantial economic benefits to the Okanagan bioregion that accrue from being able to process food locally.

In order to examine the economic impacts of increased food processing in this section, we examine two versions of the Regionalized Food System scenario. In one version, the regionalized food system impacts are estimated using current processing capacity in the Okanagan bioregion (as of year 2016), and in the other, with necessary processing capacity so that all required food can be processed within the bioregion itself

When necessary processing capacity is available locally, more raw food can be processed into value-added products. As a result, the value of food production (both raw and processed) in the food system with necessary processing capacity is $105 million greater than the food system with 2016 capacity (Table 4). Increased food processing within the bioregion leads to more economic activity and creates additional connections between industries, resulting in substantially greater economic impacts within the bioregion. When necessary processing capacity is developed, the total GDP impacts of the regionalized food production system increases by $27 million, 23% higher than the total GDP impacts of a regionalized food system with 2016 processing capacity. Total employment income increases by 20%, total tax revenue by 22% and the number of FTE jobs increases by 26%. These larger economic impacts are driven by higher total values of processed food production and higher capacity to process food within the bioregion.

These results illustrate the role of the processing sector in generating economic impacts. Increasing the capacity of the local processing sector raises the total value of food produced locally, which in turn increases economic impacts measured by output, GDP, employment income, tax revenue and number of jobs. As such, for the Okanagan bioregion to fully realize economic benefits illustrated in this report development of necessary regional post-production capacity is crucial. Hansen and Mullinix (2020) provides additional information on the regional post-production sector gaps in the Okanagan and draws on case study examples to identify strategies for building regional post-production capacity in the bioregion.

Scenarios	Regionalized Food System (2016 processing capacity)	Regionalized Food System (necessary processing capacity)
Total production (tonnes)	302,000	302,000
Value of total raw food production ($M)	291	291
Value of processed food products ($M)	70	175
Total GDP impacts ($M)	120	147
Total employment income impacts ($M)	84	101
Total tax revenue impacts ($M)	15	18
Total employment (FTE)	1,900	2,200

Table 4: Comparison of the regionalized food system with 2016 processing capacity, to a regionalized food system with necessary processing capacity

The Economic Impacts of Buying Local Food

The scenario analysis and related estimates in table 2, 3 and figure 1 is based on the assumption that all the bioregion's consumers prefer local food over imports and consistently chose food grown in the bioregion for their consumption. This is crucial in supporting a regionalized food system. In this section, we use available 2016 statistical data and I-O model estimates to examine the current status of local food purchasing in the Okanagan bioregion and what will happen if Okanagan bioregion residents commit themselves to increasing local purchase of local food[9]?

In 2016, if consumers had doubled the amount of local food purchasing[10], total output would increase by $41 million, total regional GDP by $14 million; total employment income by $9 million and tax revenue by $2 million. In addition, 222 additional full-time equivalent jobs would be created locally. By increasing local food purchase, the economic benefits related to purchases of fresh food can be captured in the bioregion rather than being lost to other regions. These are significant increases in economic impacts.

Buying local food not only directly benefits local farmers in the region, it retains and recirculates money in the bioregion benefiting other industries and individuals in the economy. For example, local farmers that profit from the sales of local produce are highly likely to spend their money locally by purchasing supplies and inputs and acquiring services such as equipment repair. In this way, money can exchange hands several times within the community, increasing the economic benefit to the region. A 2019 survey in BC found that local independent businesses in BC recirculate up to 63% of their revenue back into the local economy compared to 14% for multinational corporations. Moreover, they spend up to 31.4% of their revenue on B.C. products and services (LOCO BC, 2019).

Other consumer surveys consistently find significant consumer interest in buying local. For example, a 2018 survey conducted by the BC government revealed that 80% of respondents were interested in supporting the local economy through their purchases of local food (BC Stats, 2018). In a recent consumer survey on food access, concerns and perceptions during COVID-19 first wave, BC residents cited increased access to locally grown food as a key support they needed to improve food access. Generally, respondents wished to support local producers and see more locally grown products available at an affordable price and indicated that government should do more to promote local-regional food systems (Polasub et. al., 2020). These findings are encouraging and indicate that the local population is very interested in supporting the local food system through their food purchases.

Restaurant willingness to buy local food as ingredients

Similar to consumers, the food service sector can also play a major role in increasing purchases and consumption of local food in the bioregion. A survey of restaurant patrons in the bioregion found that 88% of respondents considered it important that their restaurant meals contain local ingredients and were willing to pay a premium (Wijekoon et.al., 2020).

In 2016, based on our I-O model estimation, if food services in the Okanagan bioregion doubled pending on local fresh food from the Okanagan, regional impacts could increase significantly. Total output would increase by $21 million, total regional GDP by $7 million; total employment income in the Okanagan bioregion by $4 million and tax revenue by $1 million. In addition, 108 additional full-time equivalent jobs would be created locally.

These economic benefits can only be realized if the food service industry commits to increasing local sourcing, which requires producers and local restaurants to work together to build capacity. Related research on the farm to restaurant supply chain in the Okanagan bioregion found that building and maintaining relationships between chefs and farmers is an important element in determining the success of supporting farm to restaurant sales. Development of specific post-production infrastructure to process, store and distribute to food service establishments is also important. Convenience, distribution, payment and logistics are often barriers to improving farm to restaurant supply chains that needs to be addressed.

Conclusion

The focus of this study was on the economic outcomes of regionalizing the food system in the Okanagan bioregion. Regionalizing the food system can be achieved in different ways. However, in this study we measured regionalization in terms of maximizing food self-reliance, which means producing foods that best meet local food need.

Using different hypothetical future scenarios in 2050 and a 2016 current food system, we compared the economic outcomes to help demonstrate how regionalization of the food system might benefit the Okanagan bioregion's economy. Economic outcomes were measured in terms of bioregional output, GDP, employment income, number of FTE jobs, and tax revenue.

Our study revealed that local food production (both raw and processed), stimulates higher and more diverse economic activity within the local region. Not only does it increase economic activities related to food production, it also impacts other industries such as those that supply inputs used in the production and processing of crop and livestock products (such as fertilizer, pesticide, truck transport, etc.). It also creates activities in other industries as workers in food production and supplier industries spend their income on services such as food, housing, utilities and financial services, etc. In addition, it was revealed that the development of bioregional food processing activities increases the value of food produced and the magnitude of economic impacts. Moreover, increased willingness to purchase local food also contributes to greater local economic impacts.

The scenario analysis reveals that in the current (2016) food system in the Okanagan bioregion, the bioregion cannot produce all food required by its population. However, by regionalizing (growing foods that best satisfy local food need) the bioregion could increase its food production related economic impacts. In the regionalized food system, there are no exports because all food that is grown is consumed regionally. Given the high economic value of the Okanagan bioregion's tree fruit and wine grape export sector this results in a sizable loss in economic impacts. If we regionalize the food system while maintaining 2016 levels of apple, sweet cherry and wine grape production and beverage production, we can achieve the highest economic impacts among all scenarios considered. By expanding land onto all agriculture land available in the Okanagan bioregion, and higher economic impacts can be achieved. However, doing so negatively impacts wildlife habitat quality. If land is set aside to protect critical wildlife habitat, food production capacity and economic impacts decrease somewhat.

The scenario analysis reveals that there is no single scenario that achieves all desired outcomes of a bioregional food system. Each option has its benefits and drawbacks. We will have to make decisions on what to prioritize.

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Endnotes

1 Food self-reliance measures the amount of the local population's diet that could theoretically be satisfied by locally produced food by comparing the quantity and types of food consumed in a region to what is produced there (Dorward, Smukler, and Mullinix, 2017)

2 Grazing land that is outside of the ALR but within in the Okanagan bioregion contributes to livestock production in the bioregion, however the land area is not included in the model.

3 See Dorward, Smukler, and Mullinix (2016) for method of determining food consumption or food need and a list of all foods considered in the models.

4 Developed by Lillian Hallin using data from Statistics Canada's Supply Use Tables for 2016.

5 All industries except Aquaculture were included under the NAICS 111 and 112 industries.

6 When BC data from Statistics Canada was available, average annual price was calculated by dividing the amount of total marketed production (in tonnes) with the total farm gate values (in dollars). When BC data was not available, Western province or Canadian data were used.

7 Please refer to the Appendices A through E for direct, indirect and induced GDP impacts and impacts by industries

8 To learn more about how quality of wildlife habitat is measured please reference the following technical brief: Rallings, A and Mullinix, K. (2021). Impacts of Agricultural Production on Wildlife and Biodiversity in the Okangan Bioregion. Richmond, British Columbia: Institute for Sustainable Food Systems, Kwantlen Polytechnic University.

9 Estimates were generated by Lillian Hallin, using a proprietary input-output model developed using data from Statistics Canada's Supply Use Tables for 2016.

10 This theoretical exercise is used only for illustrative purposes. Given current dietary preferences, production capacity and land availability, it may not be possible for consumers to double their purchase of locally grown food. For more information on the Okanagan bioregion's food self-reliance capacity, please refer to Polasub et. al (2020).

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Appendices

Appendix A: Detailed output impact estimates, in millions of dollars.

Scenario	Economic output, in millions of dollars			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: 2016 Food System				
Crop, Greenhouse and Animal Production ($M)	175	48	0	223
Fruit, Vegetable, Dairy and Meat Processing ($M)	109	5	0	114
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	8	3	10
Total ($M)	285	61	3	349
Scenario: Business as Usual (BAU)				
Crop, Greenhouse and Animal Production ($M)	172	48	0	220
Fruit, Vegetable, Dairy and Meat Processing ($M)	124	5	0	129
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	8	3	11
Total ($M)	295	62	3	360
Scenario: Farmland Loss				
Crop, Greenhouse and Animal Production ($M)	135	39	0	174
Fruit, Vegetable, Dairy and Meat Processing ($M)	116	4	0	120
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	6	2	9
Total ($M)	251	50	2	303
Scenario: Regionalized Food Production				
Crop, Greenhouse and Animal Production ($M)	91	80	0	172
Fruit, Vegetable, Dairy and Meat Processing ($M)	293	1	0	295
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	9	3	13
Total ($M)	385	93	3	481
Scenario: Maintain Export Production				
Crop, Greenhouse and Animal Production ($M)	248	75	0	323
Fruit, Vegetable, Dairy and Meat Processing ($M)	263	1	0	264
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	13	5	17
Total ($M)	511	90	5	607
Scenario: Expand Land for Food Production				
Crop, Greenhouse and Animal Production ($M)	102	98	0	200
Fruit, Vegetable, Dairy and Meat Processing ($M)	328	2	0	329
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	10	4	14
Total ($M)	429	112	4	545

Scenarios	Economic output, in millions of dollars			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: Mitigate Habitat Impacts				
Crop, Greenhouse and Animal Production ($M)	89	97	0	186
Fruit, Vegetable, Dairy and Meat Processing ($M)	325	2	0	326
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	10	4	14
Total ($M)	414	111	4	528

Appendix B: Detailed Gross Domestic Product impact estimates

Scenario	GDP at basic prices, inmillions of dollars			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: 2016 Food System				
Crop, Greenhouse and Animal Production ($M)	85	14	0	99
Fruit, Vegetable, Dairy and Meat Processing ($M)	28	1	0	29
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	5	2	7
Total ($M)	112	20	2	134
Scenario: Business as Usual (BAU)				
Crop, Greenhouse and Animal Production ($M)	83	14	0	97
Fruit, Vegetable, Dairy and Meat Processing ($M)	31	1	0	32
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	5	2	7
Total ($M)	114	20	2	137
Scenario: Farmland Loss				
Crop, Greenhouse and Animal Production ($M)	65	11	0	77
Fruit, Vegetable, Dairy and Meat Processing ($M)	29	1	0	30
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	4	2	6
Total ($M)	94	16	2	112
Scenario: Regionalized Food Production				
Crop, Greenhouse and Animal Production ($M)	41	23	0	64
Fruit, Vegetable, Dairy and Meat Processing ($M)	74	0	0	74
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	5	2	8
Total ($M)	115	29	2	147

Scenario	GDP at basic prices, inmillions of dollars			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: Maintain Export Production				
Crop, Greenhouse and Animal Production ($M)	117	22	0	139
Fruit, Vegetable, Dairy and Meat Processing ($M)	67	0	0	67
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	8	3	11
Total ($M)	184	31	3	217
Scenario: Expand Land for Food Production				
Crop, Greenhouse and Animal Production ($M)	47	28	0	74
Fruit, Vegetable, Dairy and Meat Processing ($M)	82	0	0	82
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	6	3	9
Total ($M)	129	35	3	166
Scenario: Mitigate Habitat Impacts				
Crop, Greenhouse and Animal Production ($M)	40	27	0	68
Fruit, Vegetable, Dairy and Meat Processing ($M)	81	0	0	82
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	6	2	8
Total ($M)	121	34	2	158

Appendix C: Detailed employment income estimates (wages and mixed income including imputed rent, $M)

Scenario	Household Income ($M)			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: 2016 Food System				
Crop, Greenhouse and Animal Production ($M)	49	10	0	60
Fruit, Vegetable, Dairy and Meat Processing ($M)	19	1	0	20
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	3	1	4
Total ($M)	69	14	1	84
Scenario: Business as Usual (BAU)				
Crop, Greenhouse and Animal Production ($M)	48	10	0	59
Fruit, Vegetable, Dairy and Meat Processing ($M)	22	1	0	23
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	3	1	4
Total ($M)	71	14	1	87

Scenario	Household Income ($M)			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: Farmland Loss				
Crop, Greenhouse and Animal Production ($M)	38	8	0	46
Fruit, Vegetable, Dairy and Meat Processing ($M)	21	1	0	22
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	2	1	4
Total ($M)	59	12	1	72
Scenario: Regionalized Food Production				
Crop, Greenhouse and Animal Production ($M)	26	17	0	43
Fruit, Vegetable, Dairy and Meat Processing ($M)	52	0	0	53
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	3	2	5
Total ($M)	78	21	2	101
Scenario: Maintain Export Production				
Crop, Greenhouse and Animal Production ($M)	69	16	0	86
Fruit, Vegetable, Dairy and Meat Processing ($M)	48	0	0	49
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	5	2	7
Total ($M)	118	22	2	142
Scenario: Expand Land for Food Production				
Crop, Greenhouse and Animal Production ($M)	29	21	0	50
Fruit, Vegetable, Dairy and Meat Processing ($M)	57	0	0	57
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	4	2	6
Total ($M)	86	25	2	113
Scenario: Mitigate Habitat Impacts				
Crop, Greenhouse and Animal Production ($M)	25	21	0	46
Fruit, Vegetable, Dairy and Meat Processing ($M)	56	0	0	56
Other Food Processing, Including Animal Feed ($M)	0	0	0	0
All Other Industries ($M)	0	4	2	5
Total ($M)	81	25	2	108

Appendix D: Detailed employment impact estimates (number of jobs)

Scenario	Number of jobs			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: 2016 Food System				
Crop, Greenhouse and Animal Production ($M)	1,616	364	0	1,980
Fruit, Vegetable, Dairy and Meat Processing ($M)	305	12	0	318
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	49	14	63
Total ($M)	1,921	426	14	2,362
Scenario: Business as Usual (BAU)				
Crop, Greenhouse and Animal Production ($M)	1,582	365	0	1,947
Fruit, Vegetable, Dairy and Meat Processing ($M)	362	13	0	375
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	50	15	65
Total ($M)	1,944	430	15	2,388
Scenario: Farmland Loss				
Crop, Greenhouse and Animal Production ($M)	1,242	293	0	1,535
Fruit, Vegetable, Dairy and Meat Processing ($M)	342	11	0	353
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	41	12	53
Total ($M)	1,584	346	12	1,942
Scenario: Regionalized Food Production				
Crop, Greenhouse and Animal Production ($M)	736	608	0	1,344
Fruit, Vegetable, Dairy and Meat Processing ($M)	836	4	0	840
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	52	17	69
Total ($M)	1,572	665	17	2,254
Scenario: Maintain Export Production				
Crop, Greenhouse and Animal Production ($M)	2,215	571	0	2,787
Fruit, Vegetable, Dairy and Meat Processing ($M)	785	4	0	788
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	79	24	102
Total ($M)	3,000	655	24	3,679
Scenario: Expand Land for Food Production				
Crop, Greenhouse and Animal Production ($M)	808	742	0	1,550
Fruit, Vegetable, Dairy and Meat Processing ($M)	893	4	0	896
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	58	19	77
Total ($M)	1,700	806	19	2,525

Scenario: Mitigate Habitat Impacts				
Crop, Greenhouse and Animal Production ($M)	710	737	0	1,447
Fruit, Vegetable, Dairy and Meat Processing ($M)	881	4	0	885
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	56	18	74
Total ($M)	1,591	799	18	2,408

Appendix E: Detailed employment impact estimates (Number of Full Time Equivalent Jobs)

Scenario	Number of FTE Jobs			
	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts
Scenario: 2016 Food System				
Crop, Greenhouse and Animal Production ($M)	1,578	338	0	1,916
Fruit, Vegetable, Dairy and Meat Processing ($M)	313	13	0	325
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	48	13	60
Total ($M)	1,891	399	13	2,303
Scenario: Business as Usual (BAU)				
Crop, Greenhouse and Animal Production ($M)	1,546	339	0	1,885
Fruit, Vegetable, Dairy and Meat Processing ($M)	371	14	0	385
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	49	13	62
Total ($M)	1,917	402	13	2,332
Scenario: Farmland Loss				
Crop, Greenhouse and Animal Production ($M)	1,214	272	0	1,486
Fruit, Vegetable, Dairy and Meat Processing ($M)	350	11	0	361
Other Food Processing, Including Animal Feed ($M)	0	1	0	1
All Other Industries ($M)	0	40	11	50
Total ($M)	1,564	324	11	1,899
Scenario: Regionalized Food Production				
Crop, Greenhouse and Animal Production ($M)	722	563	0	1,285
Fruit, Vegetable, Dairy and Meat Processing ($M)	856	4	0	860
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	50	15	66
Total ($M)	1,578	619	16	2,213
Scenario: Maintain Export Production				
Crop, Greenhouse and Animal Production ($M)	2,163	532	0	2,695
Fruit, Vegetable, Dairy and Meat Processing ($M)	804	4	0	808
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	76	21	97
Total ($M)	2,967	613	22	3,602

Scenario: Expand Land for Food Production				
Crop, Greenhouse and Animal Production ($M)	795	687	0	1,482
Fruit, Vegetable, Dairy and Meat Processing ($M)	914	4	0	918
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	56	17	73
Total ($M)	1,709	749	17	2,476
Scenario: Mitigate Habitat Impacts				
Crop, Greenhouse and Animal Production ($M)	697	682	0	1,379
Fruit, Vegetable, Dairy and Meat Processing ($M)	902	4	0	906
Other Food Processing, Including Animal Feed ($M)	0	2	0	2
All Other Industries ($M)	0	54	16	70
Total ($M)	1,599	742	17	2,358

Appendix F: Detailed tax revenue impact estimates

Scenario	Federal ($M)	Provincial ($M)	Local ($M)	Total tax revenue ($M)
2016 Food System	9.4	5.3	2.8	17.6
Business as Usual (BAU)	9.6	5.5	2.8	17.8
Farmland Loss	8.1	4.6	2.2	14.9
Regionalized Food Production	10.7	6.7	1.8	19.2
Maintain Export Production	15.5	9.0	3.9	28.4
Expand Land for Food Production	12.1	7.6	2.0	21.7
Mitigate Habitat Impacts	11.5	7.3	1.9	20.7

About the Institute for Sustainable Food Systems

The Institute for Sustainable Food Systems (ISFS) is an applied research and extension unit at Kwantlen Polytechnic University that investigates and supports sustainable agriculture and regional food systems as key elements of sustainable communities. We focus predominantly on British Columbia but also extend our programming to other regions.

Our applied research focuses on the potential of regional food systems in terms of agriculture and food, economics, community health, policy, and environmental integrity. Our extension programming provides information and support for farmers, communities, business, policy makers, and others. Community collaboration is central to our approach.

About the Okanagan Bioregion Food System Project

Communities and governments are increasingly looking to strengthen regional food systems as a way to address many complex agriculture and food challenges. The Okanagan Bioregion Food System Project explores the social, economic, and ecological outcomes of a regional food system in the Okanagan. This multidisciplinary research project, initiated by ISFS and regional partners, can guide conversations among communities and decision-makers seeking to advance their regional food system.

The Okanagan Bioregion Food System Project considers and builds upon existing food system planning and other related work to support local and regional food systems in the bioregion.

For the full report and more research briefs visit: www.kpu.ca/isfs/okanagan-bioregion

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