Dollars & Sense

Opportunities to Strengthen Southern Ontario's Food System

Econometric Research Limited
Harry Cummings & Associates
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The J.W. McConnell Family Foundation

METCALF FOUNDATION

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The J.W. McConnell Family Foundation

La fondation de la famille J.W. McConnell

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DOLLARS & SENSE: Opportunities to Strengthen Southern Ontario's Food System

TABLE OF CONTENTS

Foreword

In recent years, the Friends of the Greenbelt Foundation, the George Cedric Metcalf Charitable Foundation, and the J.W. McConnell Family Foundation have worked to strengthen sustainable food systems across the country through initiatives that increase market access for farmers, build or improve supply chains, protect prime farm land, help new farmers, raise public awareness about sustainably produced food, and bring about changes in public policy.

This report has two objectives. First, to better understand the economic and environmental impacts of regional food systems. Second, to assess how increasing regional food production and distribution would affect the larger food system, including businesses that supply farmers, food processors and distributors as well as food retailers and food service operations. Southern Ontario, a nationally significant food production region that grows 98% of the province's food, was chosen as the focus area. However, the patterns and scenarios outlined are relevant to local food systems in other geographies.

Ontario is a major net food importer, and this study concludes that we are missing regional economic development opportunities to enhance and support the production and distribution of local food. The authors estimate that more than half of Ontario's $20 billion in imported food products could be produced in the province. If local production were expanded to replace even ten percent of the top ten fruit and vegetable imports, the Ontario economy would gain close to quarter of a billion dollars in GDP and 3,400 full-time jobs. The research also demonstrates that when more food is produced locally, energy use and pollution from transportation are reduced.

Much of the recent growth of the local food movement has been driven by consumer demand. Our view is that the potential for local food systems to build healthy economies, protect the environment and strengthen social fabrics is far from being fulfilled. The report makes the case for investing in the development of regional food systems and providing the supportive regulatory environment, infrastructure, and distribution networks required for these systems to flourish.

We hope that this research will inform and stimulate public discussion, inspire policy change, and increase investment in regional food systems, in Ontario and beyond.

Sandy Houston
President and CEO
George Cedric Metcalf Charitable Foundation

Stephen Huddart
President and CEO
The J.W. McConnell Family Foundation

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CEO
Friends of the Greenbelt Foundation

Executive Summary

ONTARIO'S $63 BILLION FOOD SYSTEM

Ontario's food system is huge, generating more than $63 billion in sales of food products to consumers and employing more than 767,000 people — 11% of the paid labour force. The core of the food system is the agriculture sector that generates $11.5 billion in farm products. Farmers depend on an array of businesses that supply them with resources to grow crops and produce livestock and poultry, including equipment, feed, seed and energy. The system also includes food processing and manufacturing, food distribution, food retailing and food service operations.

FOOD SYSTEM MAKES AN IMPORTANT CONTRIBUTION TO ONTARIO'S ECONOMY

Spending by farmers on resources and spending by these resource suppliers through the multiplier effect result in $29.3 billion in economic activity across the province. This gross value of farm production creates 214,000 full-time-equivalent (FTE) jobs in Ontario and sustains provincial value added or gross domestic product (GDP) of $15.1 billion. All levels of government benefit from this economic activity, which creates $4.4 billion in tax revenues.

Adding in the economic impact based on food processing and manufacturing, which includes the contribution of farmers as upstream suppliers, the level of economic activity increases to $53.7 billion. This leads to $21.3 billion in provincial GDP, 273,500 FTE jobs across Ontario, as well as $6.9 million in tax revenues. Most of the food manufacturing occurs within the Greater Golden Horseshoe and these economic benefits are more concentrated in this region.

FOOD SYSTEM HAS ENVIRONMENTAL IMPACTS

The production of food, from crop and animal agriculture, through food processing and manufacturing, has an impact on the environment. To gauge this, the study applied a series of indicators tied to the economic impact of farming and food manufacturing, including the multiplier effect. The indicators are: water demand/balances, air emissions/pollutants, energy demands, greenhouse gases (GHG), solid waste, contaminants, and green GDP. As part of the environmental analysis, the study specifically focused on traffic pollutant emissions to estimate the environmental impact from transporting agricultural products — and how changes in the food system might affect this. The movement of cereals — mainly from Southwestern Ontario — accounts for more than 80% of the transportation-related emissions due to agriculture. The study observes that transportation is just one component of the overall food system's environmental impact: transportation accounts for 70% of carbon monoxide emitted in the food system, but only 7% of carbon dioxide emissions.

Opportunities to Strengthen Southern Ontario's Food System

CURRENT OUTLOOK

ONTARIO FOOD SYSTEM OVERVIEW

SALES GENERATED

$63 billion

GROWTH POTENTIAL

$10 billion

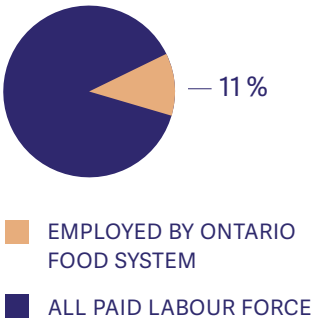
CORE OF THE FOOD SYSTEM

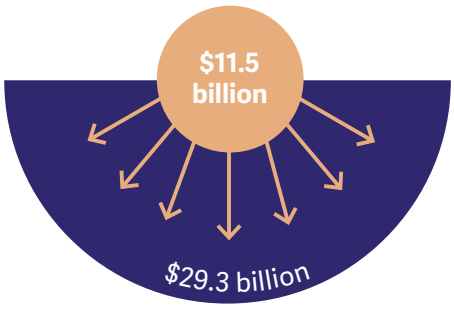
Agriculture

generating $11.5 billion in farm products and $29.3 billion in spending by farmers and their suppliers

PEOPLE EMPLOYED

767,000





ECONOMIC CONTRIBUTION

GROSS VALUE OF FARM PRODUCTION, FOOD PROCESSING & MANUFACTURING

$53.7 billion

RESULTING TAX REVENUES

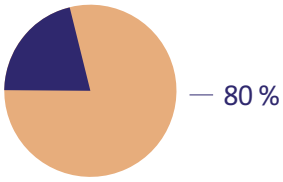
$6.9 billion

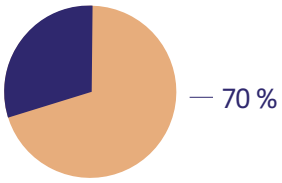
RESULTING JOBS

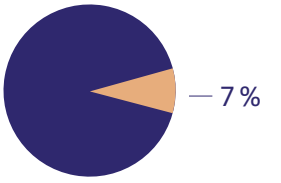
273,500

ENVIRONMENTAL IMPACTS

TRANSPORTATION-RELATED EMISSIONS DUE TO AGRICULTURE







FUTURE POSSIBILITIES — SCENARIOS

REPLACING FOOD IMPORTS

CURRENT IMPORT OF FOOD

$20 billion per year

GROWTH POTENTIAL

50% +

of currently imported food could be produced in Ontario

EFFECTS OF REPLACING 10% OF TOP 10 FRUIT & VEGETABLE IMPORTS WITH ONTARIO GROWN PRODUCE

~$250 million

GDP (Gross Domestic Product) increase

3,400

New, full-time-equivalent jobs

less imported produce

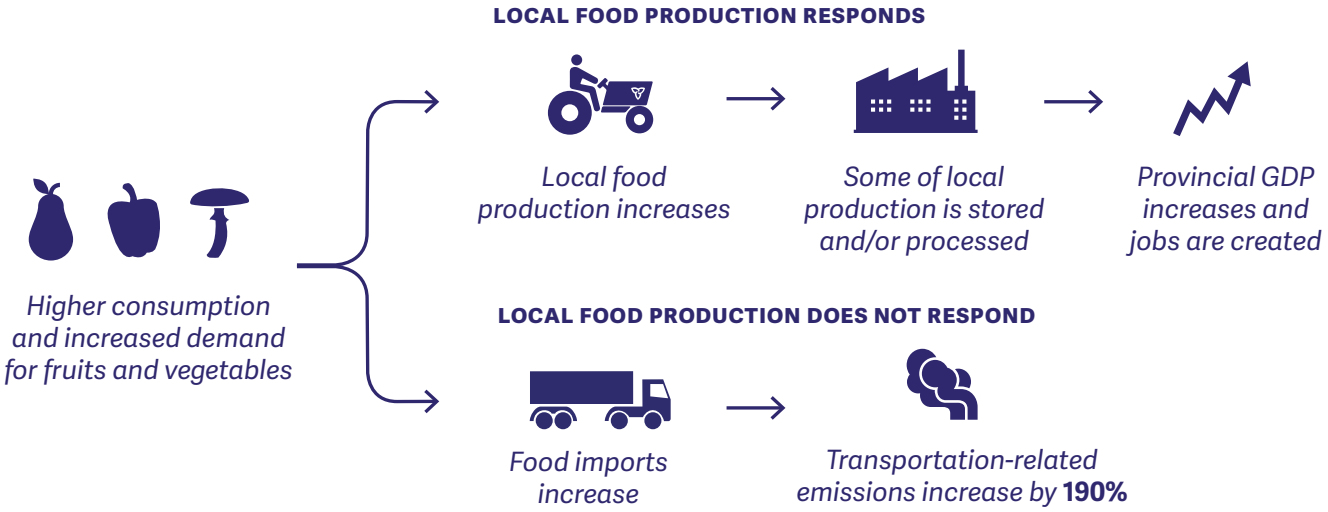
↓

reduced transportation

↓

reduced environmental impact

SHIFTING TO AN OPTIMAL DIET



TRANSITIONING TO ORGANIC PRODUCTION

% OF ORGANIC FARMING IN ONTARIO

CURRENT ~2% → **REALISTIC & DESIRABLE** 10% +

reduced pesticide & chemical fertilizer application

reduced antibiotics and medication use in animal feed

lower energy demands & emissions

improved farm incomes

REPLACING FOOD IMPORTS CREATES GROWTH OPPORTUNITIES

One unmistakable feature of the food system is that Ontarians consume more food than the province produces, resulting in food imports that approach $20 billion per year. Over 50% of the $20 billion in imported food products can be produced in Ontario. For example, if Ontario production expanded to replace 10% of the top 10 fruit and vegetable imports, the Ontario economy could benefit by nearly an additional quarter of a billion dollars in GDP and 3,400 more FTE jobs. As well, with fewer imports, transportation requirements to ship food from out-of-province supply sources also decrease, reducing the environmental impact of the food system.

OPTIMAL CONSUMER DIET COULD RESHAPE FOOD SYSTEM

An optimal diet, based on Canada's Food Guide, leads to higher consumption of fruits and vegetables, increasing consumer demand for most of these products. As fruits and vegetables are high-value-per-acre crops, expanded local production would generate more economic activity in these and related sectors.

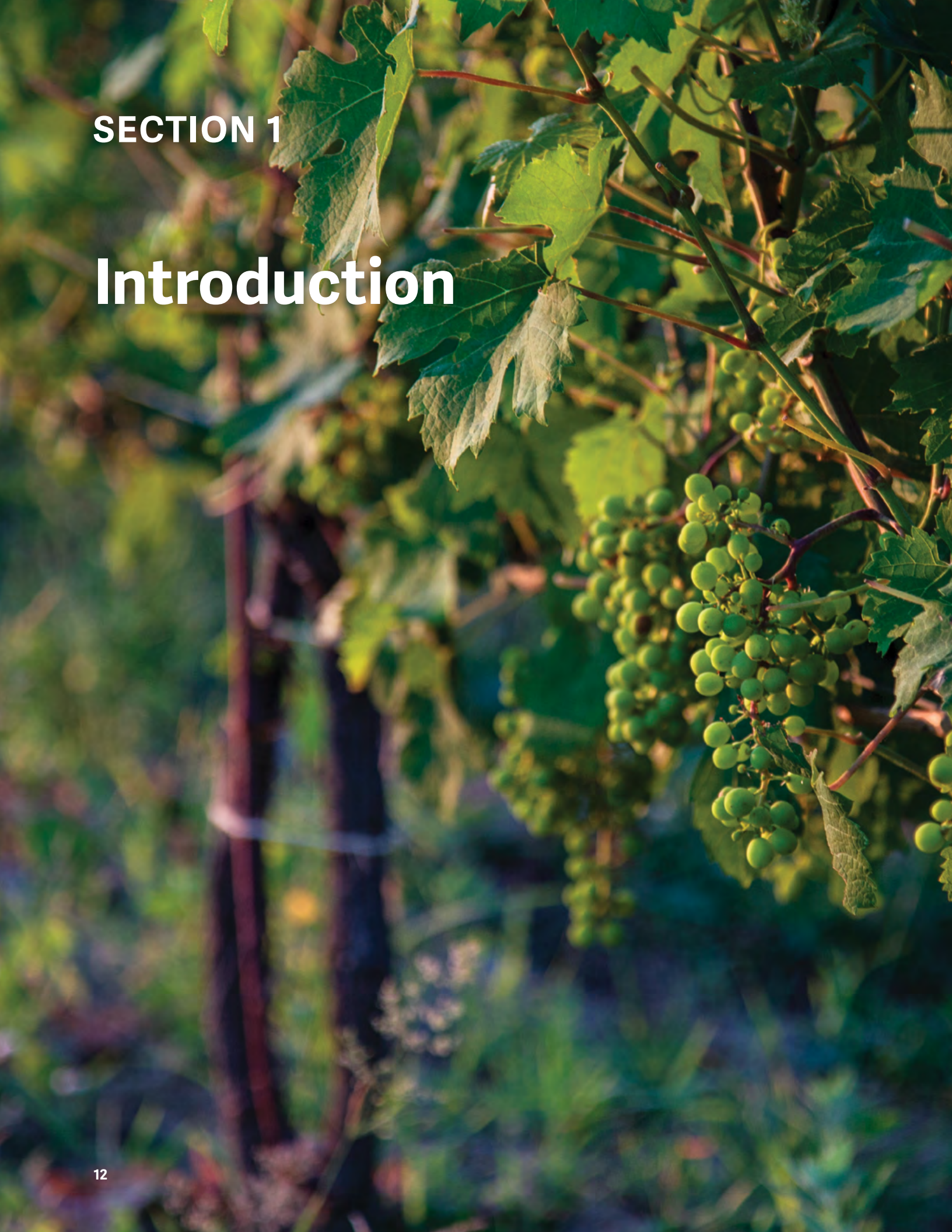
Apples and carrots are examples of storable fruit and vegetable crops. Local production can be stored under controlled atmospheric conditions to supply market requirements for most of the year. As well, processing of perishable fruits and vegetables means local production can meet local requirements for a much longer post-harvest period. Increased reliance on storage and processing can move the food system towards a more optimal diet for Ontarians and result in more locally produced food. It also creates more jobs throughout the province, increases provincial GDP, and avoids an increase in imports and the related environmental impact from transporting food long distances.

However, if local production does not expand to meet higher consumption levels, the food system will require more imports, bringing more transportation emissions. In this case, for major fruits and vegetables, transportation-related emissions under the optimal diet scenario increase by 190%, which for CO_2 is an increase of 93,000 tonnes. The largest emission impact is in carrots followed by potatoes, apples, and green beans — products that have large local supply deficits based on an optimal diet.

Although likely reductions in consumption of animal products under an optimal diet were not modelled, the study found that the impact on local animal production in aggregate might not be as significant as sometimes assumed, while GHG emissions would be reduced.

CONSEQUENCES OF SWITCHING TO ORGANIC PRODUCTION

A food system based on organic production and consumption can improve farm incomes and reduce the environmental impact of food production. The study examined the impacts of a 100% transition to organic agriculture and a more feasible 10% transition over 15 years. Because organic yields are in most cases lower than conventional, the 100% transition scenario produces supply deficits for many commodities previously in surplus, as well as larger deficits for other commodities. Surpluses remain for several small grains and some vegetables. Quite likely, larger supply deficits would require significant levels of organic imports, somewhat offsetting the environmental benefits of widespread organic production in Ontario. A more feasible 10% transition scenario results in far less supply chain disruption, with many commodities returning to surplus compared with the 100% transition.



SECTION 1

Introduction

The food system begins with the businesses that supply farmers with resources to grow crops and produce livestock and poultry products (as illustrated in Figure 1), and it ends with total sales of $63 billion worth of food to Ontario consumers.

The linchpin of the system is the agricultural sector — that is, farming. In 2012, farmers sold $11.5 billion in primary products. Most of these shipments went to food processors and manufacturers that shipped just under $40 billion in food products to customers. Most of these customers, such as food retailers and food service operations, were in Ontario, while some were in other provinces and in export markets.

Section 2 analyzes Ontario's farm output in depth and highlights the wide variety of products coming from the province's farms. Despite this abundance, Ontario imports almost $20 billion in food to supply internal market requirements, while exporting almost $11 billion. These trade flows (also shown in Figure 1) are analyzed in Section 3.

Southern Ontario is a large and diverse food-producing area, with some regions producing more of some commodities than they consume and less of other products than they need. Section 3 also provides an overview of the food surplus or deficit position in four specific regions within Southern Ontario. These food balances point to opportunities for the food system to better match Ontario consumption and production by producing more food locally.

The food system has a strong province-wide economic impact, providing more than 767,000 jobs — from farmers' fields to the check-out counter at the grocery store. Moreover, the economic impact of agriculture and food production extends well beyond the food system. The linkages between businesses in the system and the rest of the economy result in many transactions outside the system itself. Section 4 summarizes the contribution from farming and food manufacturing to overall Ontario economic activity, employment, value added (or gross domestic product, GDP)[1] and tax revenue.

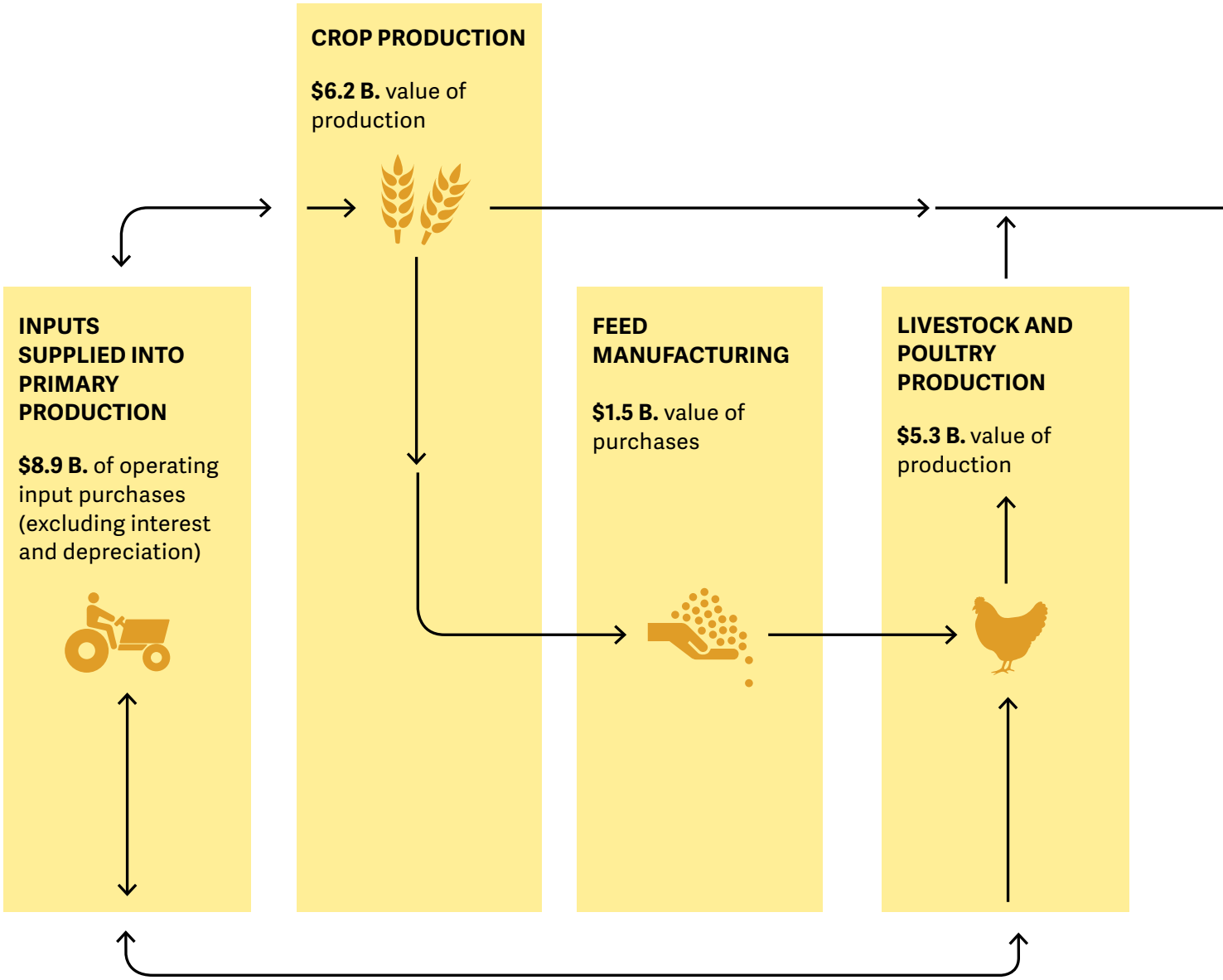
In tandem with its economic impact, the food system has significant environmental consequences. Section 5 provides a summary of modeled environmental impacts, based on all economic activity connected with farming and food manufacturing. It also takes a close look at the environmental impact of transporting agricultural products.

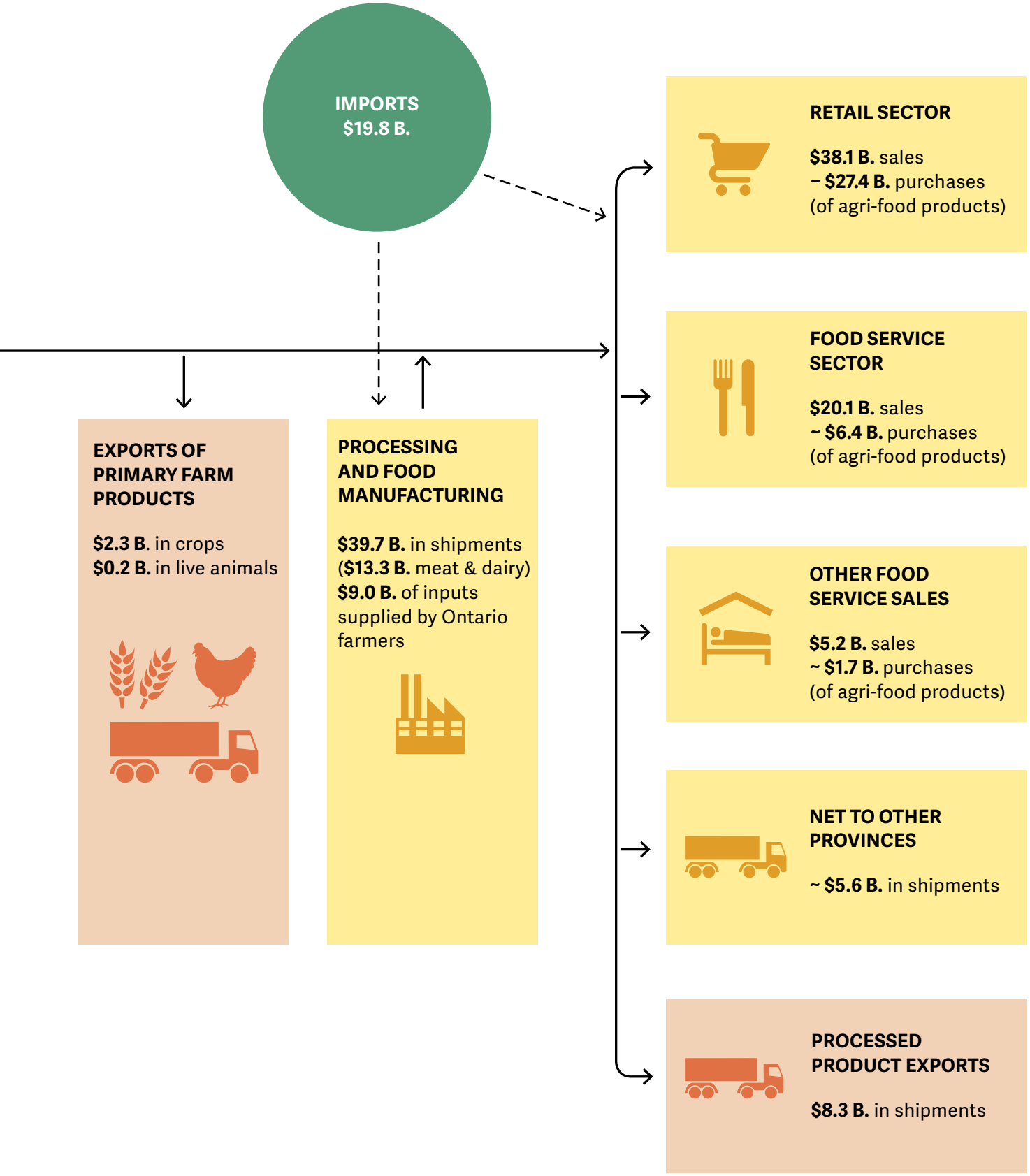
After establishing the baseline impacts of Ontario's food system on the economy and environment, the report considers some scenarios that would increase the production of local food. Section 6 examines five scenarios ranging from replacing some food imports with more local production, to adopting a healthier diet, and moving toward more organic food.

Section 7 presents an overview of the study's findings.

FIGURE 1 → Overview of the Ontario Agri-Food Sector and Value of Shipments, 2012

SOURCE:
JRG Consulting Group




IMPORTS
$19.8 B.
EXPORTS OF PRIMARY FARM PRODUCTS
$2.3 B. in crops
$0.2 B. in live animals
PROCESSING AND FOOD MANUFACTURING
$39.7 B. in shipments
($13.3 B. meat & dairy)
$9.0 B. of inputs supplied by Ontario farmers
RETAIL SECTOR
$38.1 B. sales
~ $27.4 B. purchases
(of agri-food products)
FOOD SERVICE SECTOR
$20.1 B. sales
~ $6.4 B. purchases
(of agri-food products)
OTHER FOOD SERVICE SALES
$5.2 B. sales
~ $1.7 B. purchases
(of agri-food products)
NET TO OTHER PROVINCES
~ $5.6 B. in shipments
PROCESSED PRODUCT EXPORTS
$8.3 B. in shipments

SECTION 2

Crop and Animal Agriculture in Southern Ontario

This report focuses on Southern Ontario, where the province's crop and animal agricultural activity is concentrated. This area, which lies predominately south of the Canadian Shield, accounts for 98.5% of the province's farm output, as measured by farm cash receipts.

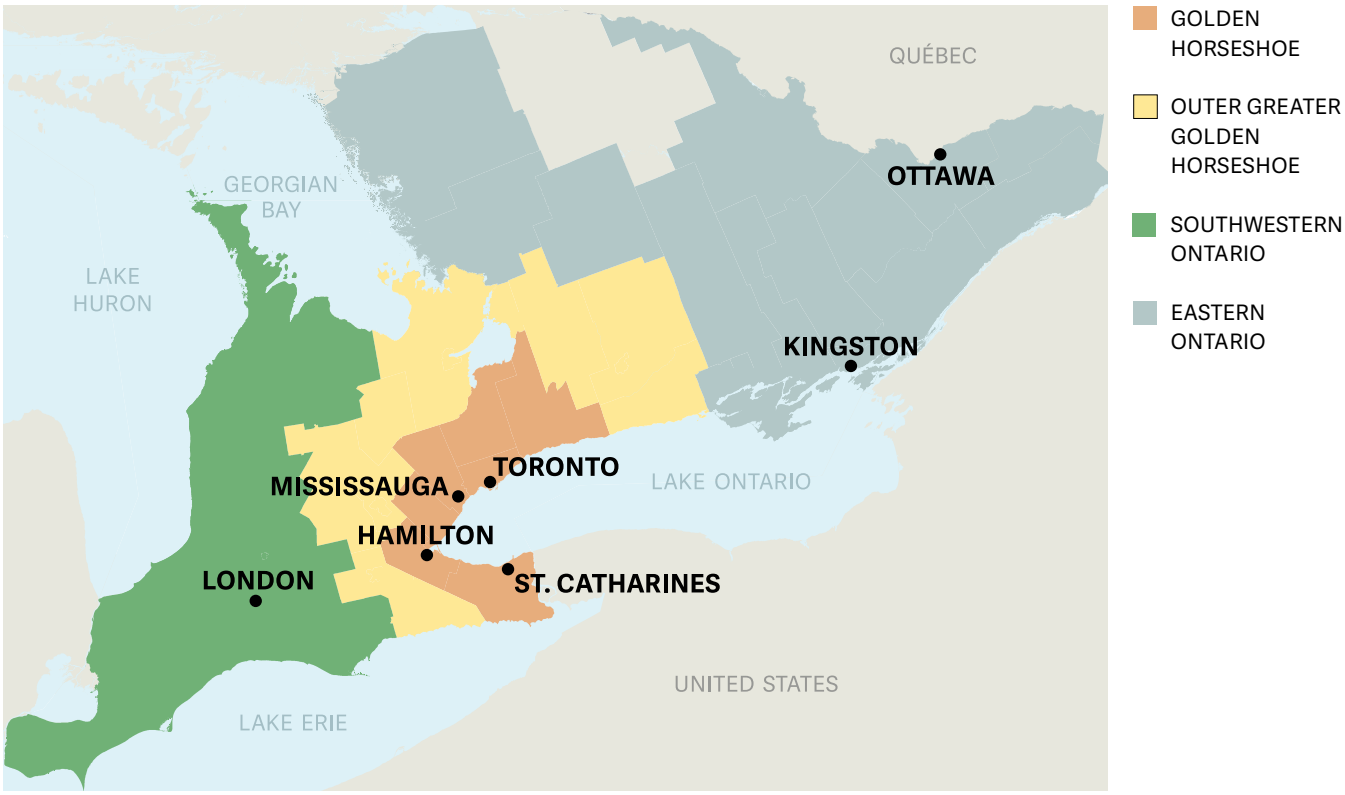
In this report Southern Ontario is segmented into four regions, as illustrated in Figure 2:

- The five regions and two cities in the **Golden Horseshoe**;[2]
- The one region and eight counties in the **Outer Greater Golden Horseshoe**;[3]
- The 11 counties in **Southwestern Ontario**;[4]
- The one city and 12 counties in **Eastern Ontario**.[5]

The report also refers occasionally to the Greater Golden Horseshoe, which includes both the Golden Horseshoe and the Outer Greater Golden Horseshoe.

The 2011 Census of Agriculture[6] indicates that most of Southern Ontario's farm output occurs to the west of the Greater Golden Horseshoe (at 52%) as

FIGURE 2 → Southern Ontario Regions Used for Analysis



reported in Table 1. The Golden Horseshoe accounts for 15% of farm output in Southern Ontario, while the outer Greater Golden Horseshoe accounts for 36% and the region to the east 12%.[7]

TABLE 1 → Farm Output across Southern Ontario (2010)

ITEM (UNITS)	GOLDEN HORSESHOE	GREATER OUTER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
OUTPUT ($ MILLION)	$1,716	$2,432	$6,124	$1,438	$11,710
DISTRIBUTION (%)	15%	21%	52%	12%	100%

Across Southern Ontario the 10 counties and regions that contribute most to agricultural output (in descending order) are: Huron, Essex, Perth, Niagara, Oxford, Wellington, Middlesex, Chatham-Kent, Waterloo, and Lambton.[8] Niagara, which specializes in fruit production, is the only area from the Golden Horseshoe in the top-10 list. Wellington and Waterloo are from the Outer Greater Golden Horseshoe, with the remaining seven counties in the top 10 lying to the west.

CROP AGRICULTURE ACROSS SOUTHERN ONTARIO

Soybean and corn production are the dominant uses of crop land, with 70% of total acreage in Southern Ontario devoted to these two commodities.

Specialization is a fundamental trait of Ontario agriculture. Table 2 shows the area devoted to significant crops in the four regions across Southern Ontario.[9] Soybean and corn production are the dominant uses of crop land, with 70% of total acreage in Southern Ontario devoted to these two commodities. In the case of corn (including fodder corn) 57% of the production occurs in Southwestern Ontario, with 25% in the outer Greater Golden Horseshoe and 18% to the east. A similar pattern occurs for soybeans.

A strong pattern of commodity specialization can be seen by both region and county. The Outer Greater Golden Horseshoe accounts for 46% of canola acreage (mostly Simcoe, Wellington and Dufferin Counties) and 59% of potato production (primarily Simcoe and Dufferin).

Grey County dominates in the production of apples, while Chatham-Kent is the leading producer of field tomatoes and Brussels sprouts, and Huron County leads in field crops, particularly corn. Essex County is the primary source of greenhouse vegetables, while Simcoe County is the prominent supplier of potatoes and Christmas trees.

TABLE 2 → Location of Crop Agriculture across Southern Ontario (2011)

	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	NOT REPORTED (CONFIDEN-TIALITY)*	ALL SOUTHERN ONTARIO
TOTAL WHEAT	ha	34,626	105,070	318,985	26,094	26,102	484,783
DISTRIBUTION	%	7%	22%	66%	5%	5%	100%
TOTAL CORN	ha	68,702	164,933	532,523	163,304	163,330	929,488
DISTRIBUTION	%	7%	18%	57%	18%	18%	100%
CANOLA (RAPESEED)	ha	1,568	10,788	8,805	1,202	2,517	23,678
DISTRIBUTION	%	7%	46%	37%	5%	11%	100%
SOYBEANS	ha	88,899	180,314	573,905	150,064	150,332	993,450
DISTRIBUTION	%	9%	18%	58%	15%	15%	100%
ALFALFA AND ALFALFA MIXTURES	ha	48,614	154,366	164,066	142,398	142,396	509,442
DISTRIBUTION	%	10%	30%	32%	28%	28%	100%
POTATOES	ha	1,154	8,552	3,876	831	854	14,436
DISTRIBUTION	%	8%	59%	27%	6%	6%	100%
TOTAL AREA OF FRUITS & BERRIES	ha	12,106	1,354	6,514	1,179	1,175	21,149
DISTRIBUTION	%	57%	6%	31%	6%	6%	100%
TOTAL FIELD VEGETABLES	ha	7,641	6,256	36,168	2,103	2,104	52,169
DISTRIBUTION	%	15%	12%	69%	4%	4%	100%
SOD UNDER CULTIVATION FOR SALE	ha	5,258	1,335	568	2,283	3,807	10,968
DISTRIBUTION	%	48%	12%	5%	21%	35%	100%
NURSERY PRODUCTS GROWN FOR SALE	ha	5,037	2,003	1,829	1,070	1,199	10,068
DISTRIBUTION	%	50%	20%	18%	11%	12%	100%
CHRISTMAS TREES GROWN FOR SALE	ha	1,024	2,718	648	1,115	1,114	5,504
DISTRIBUTION	%	19%	49%	12%	20%	20%	100%
GREENHOUSE FLOWERS	m^2	2,147,782	470,656	840,258	137,209	417,542	3,876,238
DISTRIBUTION	%	55%	12%	22%	4%	11%	100%
GREENHOUSE VEGETABLES	m^2	681,928	19,417	6,692,124	131,773	598,951	7,992,420
DISTRIBUTION	%	9%	0%	84%	2%	7%	100%
MUSHROOM GROWING AREA	m^2	39,216	0	70,625	87,170	157,419	267,260
DISTRIBUTION	%	15%	0%	26%	33%	59%	100%

*NOTE: The column titled "not reported" captures the County Specific data that could not be reported due to confidentiality reasons, such as fewer than three operations in a County (based on Census of Agriculture 2011 data). The Southern Ontario value is as reported by Statistics Canada. The 2011 Census data which provides acreage values at the county level every five years was used to provide a baseline for the analysis in this report. It should be noted that levels of production and land area farmed can vary from year to year.

TABLE 3 → Location of Fruit and Vegetable Production across Southern Ontario (2011)

	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	NOT REPORTED (CONFIDEN-TIALITY)*	ALL SOUTHERN ONTARIO
APPLES TOTAL AREA	ha	1,109	748	4,157	366	368	6,382
DISTRIBUTION	%	17%	12%	65%	6%	6%	100%
PEARS TOTAL AREA	ha	399	37	111	13	12	559
DISTRIBUTION	%	71%	7%	20%	2%	2%	100%
PLUMS AND PRUNES TOTAL AREA	ha	381	2	34	8	18	435
DISTRIBUTION	%	88%	0%	8%	2%	4%	100%
CHERRIES (SWEET) TOTAL AREA	ha	180	3	45	0	2	230
DISTRIBUTION	%	78%	1%	20%	0%	1%	100%
PEACHES TOTAL AREA	ha	2,316	0	237	0	57	2,610
DISTRIBUTION	%	89%	0%	9%	0%	2%	100%
GRAPES TOTAL AREA	ha	6,522	24	575	287	317	7,438
DISTRIBUTION	%	88%	0%	8%	4%	4%	100%
STRAWBERRIES TOTAL AREA	ha	294	225	449	262	271	1,239
DISTRIBUTION	%	24%	18%	36%	21%	22%	100%
RASPBERRIES TOTAL AREA	ha	88	54	83	114	114	339
DISTRIBUTION	%	26%	16%	24%	34%	34%	100%
SWEET CORN	ha	1,061	817	7,594	768	769	10,241
DISTRIBUTION	%	10%	8%	74%	7%	8%	100%
TOMATOES	ha	238	163	6,181	112	112	6,694
DISTRIBUTION	%	4%	2%	92%	2%	2%	100%
CUCUMBERS	ha	59	27	1,200	53	112	1,398
DISTRIBUTION	%	4%	2%	86%	4%	8%	100%
GREEN PEAS	ha	63	83	5,618	28	339	6,103
DISTRIBUTION	%	1%	1%	92%	0%	6%	100%
GREEN AND WAX BEANS	ha	60	380	2,645	119	621	3,706
DISTRIBUTION	%	2%	10%	71%	3%	17%	100%
CABBAGE	ha	155	111	791	17	291	1,348
DISTRIBUTION	%	11%	8%	59%	1%	22%	100%
CHINESE CABBAGE	ha	357	247	74	7	72	750
DISTRIBUTION	%	48%	33%	10%	1%	10%	100%
CAULIFLOWER	ha	294	101	96	94	174	665
DISTRIBUTION	%	44%	15%	14%	14%	26%	100%
CARROTS	ha	1,254	671	1,996	29	61	3,982
DISTRIBUTION	%	31%	17%	50%	1%	2%	100%
DRY ONIONS	ha	769	673	1,046	25	120	2,608
DISTRIBUTION	%	29%	26%	40%	1%	5%	100%
CELERY	ha	102	91	0	2	56	249
DISTRIBUTION	%	41%	37%	0%	1%	22%	100%

TABLE 3 Cont'd → Location of Fruit and Vegetable Production across Southern Ontario (2011)

	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	NOT REPORTED (CONFIDEN-TIALITY)*	ALL SOUTHERN ONTARIO
LETTUCE	ha	102	44	17	30	83	246
DISTRIBUTION	%	41%	18%	7%	12%	34%	100%
PEPPERS	ha	84	66	1,341	28	82	1,573
DISTRIBUTION	%	5%	4%	85%	2%	5%	100%

*NOTE: The column titled "not reported" captures the County Specific data that could not be reported due to confidentiality reasons, such as fewer than three operations in a County (based on Census of Agriculture 2011 data). The Southern Ontario value is as reported by Statistics Canada. The 2011 Census data which provides acreage values at the county level every five years was used to provide a baseline for the analysis in this report. It should be noted that levels of production and land area farmed can vary from year to year.

The Golden Horseshoe specializes in fruit production and has 57% of Southern Ontario's land area in fruit. This is mostly due to Niagara, which leads the province with 10,500 hectares in fruit and accounts for over 85% of Golden Horseshoe fruit acreage. As noted in Table 3, grapes are the leading commodity in terms of fruit acreage, with 88% found in the Golden Horseshoe (mostly Niagara). Apples rank second in fruit production acreage, with over 65% grown in the southwestern region, primarily in Grey County.

Production of field vegetables such as tomatoes and sweet corn is concentrated in Southwestern Ontario with 69% of acreage, led by Chatham-Kent and Middlesex. Green peas, carrots, beans, dry onions, cabbages and cucumbers also have a sizeable acreage base. Southwestern Ontario is the leading supply region for these crops. The Golden Horseshoe leads in the production of celery, lettuce, cauliflower, and Chinese cabbage.

The Golden Horseshoe accounts for just under half of Ontario's sod production, which supplies the growing Greater Toronto Area (GTA marketplace). Similarly, half of nursery products (such as trees and shrubs) are grown in the Golden Horseshoe. Christmas tree production is concentrated in the Outer Greater Golden Horseshoe, mostly in Simcoe County.

As well, the Golden Horseshoe leads in greenhouse flower production with 55% of the growing area, mostly in Niagara. Greenhouse vegetables (e.g., tomatoes and peppers) are concentrated in the southwest (primarily Essex County followed by Chatham-Kent). Essex County is also highly specialized in the production of mushrooms.

Some county-specific detail on land use specialization in Southern Ontario includes the following for crops that are not used primarily for livestock feed or non-food purposes:

- Lambton County has the most wheat acreage, followed by Huron County.

- Over 50% of rye is produced in Norfolk County.
- Renfrew County shows a slightly higher share of Southern Ontario's oats production.
- Grey County has the most area planted to canola, followed by Dufferin and Wellington.
- Grey County dominates in the production of flaxseed.
- Huron County dominates in the production of dry field peas.
- Huron County accounts for the largest share (48.5%) of production of dry white beans.
- Perth County accounts for the highest share of production of other dry beans.
- Simcoe County alone accounts for 33.5% of all land devoted to the production of potatoes.
- Renfrew County is a dominant producer of sunflowers.
- Ginseng is predominantly produced in Haldimand and Norfolk.
- Stormont has the largest share of land devoted to buckwheat.
- Chatham-Kent shows a 50% share of the production of sugar beets.
- Niagara Region has the most suitable land for growing fruits and therefore makes the largest land allocations to these crops.
- Grey County accounts for 45% of acreage in apple production in Southern Ontario, with other major producing areas being Norfolk, Elgin, Durham and Northumberland.
- Norfolk is the leading supplier of strawberries.
- Niagara followed by Durham is the leading producer of raspberries.
- Chatham-Kent dominates all other counties in the production of tomatoes, followed by Essex and Norfolk; green peas, followed Middlesex and Elgin; and Brussels sprouts.
- Norfolk dominates the production of sweet corn, followed closely by Middlesex, Chatham Kent and Elgin.
- Norfolk is also the leading producer of cabbage.
- Middlesex County is a major producer of green and wax beans, followed by Chatham Kent, Elgin and Oxford.
- York Region is the leading supplier of Chinese cabbage, carrots, and dry onions.
- Hamilton is the leading supplier of broccoli and cauliflower.
- Elgin County is the leading producer of cucumbers, followed by Norfolk.
- Elgin is also the leading producer of peppers, followed by Norfolk and Chatham-Kent.
- Oxford County is prominent in the production of rutabagas and turnips.

For crops that are primarily used to feed livestock, the following is noteworthy:

- Huron County has the most corn acreage, followed by Middlesex, Perth, Oxford, and Chatham-Kent.
- The counties devoting the largest share of their acreage to corn production are Oxford (at 45%), followed by Elgin (at 40%) and Stormont (40%).

- For Essex and Haldimand, over 50% of crop acreage is in soybean production, while Lambton County has the most soy bean acreage.
- Grey County allocates the largest share of land to the production of barley and mixed grains.

ANIMAL AGRICULTURE ACROSS SOUTHERN ONTARIO

Most of the province's livestock are found in Southern Ontario with shares exceeding 95% of Ontario production by animal class. The south-west region has most of the livestock and poultry production as shown in Table 4.

Beef cattle and dairy production is concentrated in certain counties, reflecting specialization within regions.

TABLE 4 → Location of Animal Agriculture across Southern Ontario (2010)

	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	NOT REPORTED (CONFIDEN-TIALITY)	ALL SOUTHERN ONTARIO
TOTAL CATTLE AND CALVES	no.	90,587	464,314	745,264	348,968	348,968	1,649,133
DISTRIBUTION	%	5%	28%	45%	21%	21%	100%
TOTAL SHEEP AND LAMBS	no.	32,020	107,507	129,586	69,253	69,253	338,366
DISTRIBUTION	%	9%	32%	38%	20%	20%	100%
TOTAL PIGS	no.	60,202	511,214	2,402,451	108,436	108,672	3,082,539
DISTRIBUTION	%	2%	17%	78%	4%	4%	100%
HORSES AND PONIES	no.	15,388	27,306	24,543	15,244	15,244	82,481
DISTRIBUTION	%	19%	33%	30%	18%	18%	100%
GOATS	no.	6,120	28,752	62,579	15,310	15,465	112,916
DISTRIBUTION	%	5%	25%	55%	14%	14%	100%
TOTAL HENS AND CHICKENS	no.	7,414,258	13,187,213	21,158,245	5,032,735	5,032,735	46,792,451
DISTRIBUTION	%	16%	28%	45%	11%	11%	100%
CHICKEN (MEAT) PRODUCTION	kg	80,575,056	130,788,406	203,987,866	20,937,525	20,937,525	436,288,853
DISTRIBUTION	%	18%	30%	47%	5%	5%	100%
TURKEY (MEAT) PRODUCTION	kg	4,855,938	16,548,638	49,531,687	287,750	16,228,327	87,164,590
DISTRIBUTION	%	6%	19%	57%	0%	19%	100%
TABLE EGGS	dozen	13,807,457	45,082,693	94,625,376	54,404,727	60,119,098	213,634,624
DISTRIBUTION	%	6%	21%	44%	25%	28%	100%

For example:

- Fifty percent of all cattle and calves are located within the seven counties of Bruce, Wellington, Huron, Grey, Perth, Waterloo and Oxford.
- For all cattle and calves raised for beef production, about 10% are

in Bruce County, with about 45% of this inventory in the six counties of Grey, Bruce, Huron, Perth, Wellington, and Waterloo; Grey and Bruce County are tied for the number of beef cows, with these two counties accounting for 19% of all beef cows in Southern Ontario.
- Perth and Oxford are tied for having the most dairy cows with 22% of all dairy cows in Southern Ontario.

Hog production is also centred in the southwest region, with three counties — Huron, Perth and Oxford — accounting for 46% of pig inventories. When Middlesex and Wellington are included, these five counties account for 64% of total pigs on farms.

The four leading counties for total sheep, ewes, and lambs are Wellington, Huron, Bruce and Grey, with just under 30% of all Southern Ontario numbers for these animals.

The Greater Golden Horseshoe has more horses and ponies than other regions with 52% of the total. The leading counties include Wellington, Waterloo, Grey, Durham, Middlesex and York.

Goats are primarily found in Oxford and Bruce counties.

Chicken production (broilers) is concentrated primarily in three counties in Southern Ontario. These include Wellington with the largest share of total production by weight (at 14%), followed by Huron (with 13%) and Niagara (at 11%). A few other counties show relatively high shares including Oxford with 9% and Perth with 8%.

Turkey production is also centred in a few counties with 18% in Oxford, 17% in Huron, 15% in Middlesex, 12% in Haldimand-Norfolk, and 9% in Waterloo.

Wellington County produces the largest share of table eggs (11%), followed closely by Huron with 10% and Lambton at 9%.

SECTION 3

Southern Ontario Food System Surpluses and Deficits

In 2012, Ontario imported almost $20 billion in food products to meet its food consumption requirements (see Figure 1). Ontario's food deficit, as measured by the net trade balance with the rest of the world, increased from about $4 billion in 2002 to $9 billion in 2012.[10]

TRADE IN AGRICULTURAL AND FOOD PRODUCTS

As shown in the previous section, Ontario has a large food production base. However, after considering exports (e.g., live animals, soybeans, greenhouse tomatoes) and imports (e.g., meat products, tropical fruits) to satisfy the food needs of Ontarians, the value of imports exceeds exports by a wide margin. In 2012, imports (at $19.8 billion) were almost twice as large as exports (at $10.8 billion), leaving a trade deficit of $9 billion. Table 5 provides a snapshot of the value of Ontario's exports and imports of agricultural and food products in 2012.

Imports (at $19.8 billion) were almost twice as large as exports (at $10.8 billion), leaving a trade deficit of $9 billion.

Ontario's land base does not supply all of the crop products consumed in Ontario. Imports exceeded exports for fruits and nuts (by $2,804 million), tropical products excluding fruits (by $1,151 million), and vegetables (by $999 million). This explains why Ontario's fresh fruit and vegetable imports are high because the province does not have the capability to produce tropical fruits and many fruit and vegetable crops are only in season part of the year and have limited shelf life without further processing.[11]

Exports exceeded imports in only a few crops and related products, such as oilseeds (with net exports of $566 million), which are mostly soybeans, and grain products (with net export of $393 million). The large deficit in primary products was mostly due to imports of fruits and vegetables (total imports at $4.9 billion and a trade deficit of $3.8 billion in this product category).

Many livestock and poultry products are produced on farms across Southern Ontario. However, Ontario remains a major net importer of most livestock and poultry products. This includes red meat ($1.2 billion for beef, pork and lamb), poultry and eggs ($450 million), and dairy products ($86 million).[12] Ontario is a net exporter of live animals ($177 million), such as market-ready hogs and cattle. For fish and fish products there was a $700 million trade deficit.

Beverages recorded a large trade deficit of over $1,295 million. Other processed foods sustained a deficit of over $993 million. Similarly, sugar and confectionary show a deficit of $350 million, but tobacco and related products realized a surplus of $97 million in 2012.

Overall, Ontario trade measures show a large exposure to food imports and suggest that there is significant room for matching deficits in local consumption with local production. Many of these trade products where Ontario is a significant producer. Some economic theorists have concluded that such trade deficits indicate lost regional economic development opportunities.[13] This analysis implies that the focus should be on

TABLE 5 → Exports and Imports of Agri-Food Products, Ontario (2012)[14]

	EXPORTS	IMPORTS	NET EXPORTS
		$ MILLION	
CROPS AND PRODUCTS			
GRAIN PRODUCTS	$2,229	$1,836	$393
VEGETABLES	$932	$1,931	-$999
OILSEEDS	$846	$280	$566
TROPICAL PRODUCTS (EXCL. FRUIT)	$514	$1,666	-$1,151
OILSEED PRODUCTS	$486	$572	-$86
ANIMAL FEEDS	$355	$686	-$331
FRUIT AND NUTS	$195	$2,999	-$2,804
FLORICULTURE AND NURSERY PRODUCTS	$174	$201	-$27
GRAINS	$165	$262	-$97
SEEDS FOR SOWING	$103	$261	-$158
VEGETABLE FIBRES	$0	$12	-$11
CROPS AND PRODUCTS SUB-TOTAL	$6,000	$10,704	-$4,704
ANIMAL PRODUCTS			
OTHER ANIMAL PRODUCTS	$816	$339	$476
RED MEATS	$801	$1,947	-$1,145
LIVE ANIMALS	$234	$58	$177
POULTRY AND EGGS	$204	$654	-$450
DAIRY PRODUCTS	$123	$209	-$86
FISH AND PRODUCTS	$91	$791	-$700
ANIMAL PRODUCTS SUB-TOTAL	$2,270	$3,998	-$1,728
OTHER AGRI-FOOD PRODUCTS			
OTHER EDIBLE PREPARATIONS	$839	$1,833	-$993
SUGAR AND CONFECTIONERY	$782	$1,132	-$350
BEVERAGES	$585	$1,880	-$1,295
OTHER AGRI-FOOD PRODUCTS	$173	$173	$0
TOBACCO AND PRODUCTS	$172	$76	$97
OTHER AGRI-FOOD PRODUCTS SUB-TOTAL	$2,551	$5,094	-$2,543
TOTAL	$10,821	$19,796	-$8,975

SOURCE:
OMAFRA International Trade Database adapted from Statistics Canada

optimizing production and distribution for the domestic market and then trading the excess.[15]

Over 50% of the $20 billion in imported food products can be produced in Ontario. By doing so, the agri-food trade deficit would disappear, with the export value equal to import value for products that cannot be grown in Ontario. At the same time, based on 2012 figures, 22% of Ontario's primary farm production is exported. These trends imply opportunities exist to better align local production and local consumption of primary agricultural products. This would require more acreage devoted to agriculture, more processing and storage of perishable fruits and vegetables and diversion of some exports to local consumption. The bottom line: Ontario's food system has the potential to produce substantially more food within the province.

FOOD SURPLUSES AND DEFICITS IN SOUTHERN ONTARIO

As well as trade balances, the study also examined another kind of surpluses and deficits: the difference between the amount of food the province and each of the four regions produce and the amount they consume. This perspective is intended to help local food system participants find opportunities to meet consumer needs in their own regions and elsewhere in Ontario. As well, a later section in this report will show how this information can be used to calculate the environmental impact from the transportation of agricultural products.

A view of how Southern Ontario and each region fare with respect to being in a food surplus or deficit position for selected commodities is provided in Tables 6, 7, 8 and 9. The year 2011 is the reference year used. This aligns with census data[16] for each county, which allows for estimating consumption[17] and production in a region in total and on a per capita basis.[18]

Food Surpluses and Deficits — Fruit Crops

Table 6 outlines the surplus/deficit position for each region in selected fruits and vegetables.

Ontario produces less fruit than it consumes. In the case of apples, the Greater Golden Horseshoe and Eastern Ontario produce fewer apples than consumed, and only in the southwest is apple production larger than consumption. This is due to specialization, as discussed in the previous section, with Grey County being the major apple production area. Surpluses also exist in Haldimand-Norfolk, Elgin, Northumberland, and Essex. Overall, Southern Ontario produces around 60% of the volume of apples consumed — an estimated 104,000 tonnes fewer than needed — which is equivalent to a shortage of 8.6 kg per person. Apple imports account for a portion of this shortfall (at 6.9 kg/person in 2011), with the remainder being supplied by other provinces, such as British Columbia.

TABLE 6 → Fruit Surplus/Deficit by Region in Southern Ontario (2010)

PRODUCT	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO	AVERAGE ONTARIO CONSUMP-TION
APPLES	KG/PERSON	-18.9	-6.2	-16.4	43.6	-17.6	-8.6	23.5
	TONNES	-131,849	-10,454	-142,303	70,046	-31,965	-104,083	
GRAPES	KG/PERSON	2.9	-4.6	1.5	-2.0	-4.2	0.2	4.7
	TONNES	20,448	-7,740	12,708	-3,179	-7,560	2,210	
PEACHES	KG/PERSON	0.5	-2.1	-0.0	0.1	-2.2	-0.3	2.2
	TONNES	3,212.0	-3,523.1	-311.1	102.6	-3,903.9	-3,871.0	
STRAW-BERRIES	KG/PERSON	-4.3	-3.7	-4.2	-3.4	-3.8	-4.0	4.5
	TONNES	-30,153	-6,174	-36,327	-5,492	-6,979	48,758	

Ontario also exports some apples (0.44 kg/capita), predominately varieties that are in surplus. The large surpluses and deficits over short distances point to good opportunities for intercounty trade in apples in Ontario.

In grape production, Niagara, Essex, Chatham-Kent, and Prince Edward are the only areas that have a surplus, primarily due to the geography being suitable for grape production. The large grape production industry in Niagara puts the Golden Horseshoe in a surplus position. This translates into a slight surplus of grapes for Southern Ontario of 2,200 tonnes. Most grape production is for wine, with some for the juice markets and a very small percentage for table grapes, which leads to significant fresh grape imports. Local grapes are harvested in the fall, and given the limited shelf-life, fresh grapes are imported throughout the year.

Ontarians consume slightly more peaches than produced within the province, with a shortfall of 0.3 kg per person. The Golden Horseshoe and the southwest are surplus production regions. The largest peach-producing area is Niagara. A few counties in Southwestern Ontario show small surpluses (i.e., local production exceeds local consumption), namely: Chatham-Kent, Elgin, Essex, and Norfolk. All other counties in Southern Ontario show varying deficits. Ontario imports peaches, even during our growing season. The peach sector has been in decline for some years, and most of the canning capacity has been lost.

Southern Ontario has a large deficit in the production of strawberries at 4 kg per person, or 49,000 tonnes in total. There is not one county within Southern Ontario where the production of strawberries matches the local demand for this fruit. This reflects the seasonal nature of strawberry production and the ability of grocers to source fresh strawberries most months of the year through imports. Per capita consumption of strawberries for all of Ontario is 4.5 kg/person per year, with the majority of this volume supplied by imports.

Over 50% of the $20 billion in imported food products can be produced in Ontario.

In tomatoes, Southern Ontario's surplus is due primarily to the greenhouse vegetable industry in Essex County.

Food Surpluses and Deficits — Vegetable Crops

In vegetable crops, Southern Ontario produces a surplus of tomatoes, peppers, carrots and sweet corn.[19]

In tomatoes, Southern Ontario's surplus is due primarily to the greenhouse vegetable industry in Essex County. Five counties in Southwestern Ontario account for the overall surplus of greenhouse and field grown tomatoes, led by Essex and Chatham-Kent and then followed by Norfolk, Lambton and Elgin. The surplus (24.9 kg/person) is much larger than consumption (31.4 kg), with consumption including both fresh and processed tomato products (see Table 7).

Over 300,000 tonnes are available for shipment to other provinces and into export markets.

TABLE 7 → Vegetable Surplus/Deficit by Region in Southern Ontario (2010)

PRODUCT	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO	AVERAGE ONTARIO CONSUMPTION
TOMATOES	KG/PERSON	-25.6	-10.6	-22.7	352.3	-28.7	24.9	31.4
	TONNES	-179,645	-17,820	-197,465	567,083	-52,023	301,597	
PEPPERS	KG/PERSON	-3.2	-1.6	-2.8	37.7	-4.1	2.5	4.1
	TONNES	-22,081	-2,665	-24,746	60,730	-7,442	29,929	
CARROTS	KG/PERSON	-4.8	17.5	-0.4	21.6	-10.6	2.0	11.0
	TONNES	-33,381	29,497	-3,884	34,697	-19,196	23,936	
DRY ONIONS	KG/PERSON	-5.2	7.7	-2.7	14.0	-8.2	-0.6	8.4
	TONNES	-36,744	12,968	-23,776	22,579	-14,868	-7,622	
CABBAGE	KG/PERSON	-4.3	-1.4	-3.7	6.1	-5.1	-1.8	5.4
	TONNES	-29,908	-2,310	-32,219	9,827	-9,218	-21,727	
GREEN BEANS	KG/PERSON	-1.7	-0.8	-1.5	8.7	-1.8	-0.2	1.9
	TONNES	-11,990	-1,282	-13,272	13,961	-3,288	-2,082	
SWEET CORN	KG/PERSON	-6.5	2.7	-4.7	56.5	-4.8	3.4	7.7
	TONNES	-45,626	4,560	-41,066	90,925	-8,670	41,320	
POTATOES	KG/PERSON	-54.6	29.3	-38.3	-3.3	-54.2	-34.0	57.2
	TONNES	-382,703	49,484	-333,219	-5,234	-98,326	-411,733	

Southern Ontario's surplus of peppers is also based on production in Southwestern Ontario. Apart from seven counties in the southwest, most counties in the province show large deficits in the production and consumption of peppers. The largest surpluses of peppers are in Essex (primarily from greenhouse production), Chatham-Kent, and Norfolk. Elgin,

Lambton and Brant Counties also have surplus pepper production. The export volume (of approximately 85,000 tonnes) is much larger than Southern Ontario's surplus of 30,000 tonnes, due to imports in the periods where Ontario's field peppers are not in season.

For carrots, the Outer Greater Golden Horseshoe and the southwest regions are in surplus. This is due to production specialization in counties such as Simcoe, Norfolk, Middlesex and Chatham-Kent. Within the Golden Horseshoe, York Region has a significant surplus due to the Holland Marsh; however, once Toronto's requirements are considered, production from regions outside the Golden Horseshoe is necessary to fill market needs. Overall, Southern Ontario is self-sufficient in carrots.

The regions to the west of the Golden Horseshoe produce more sweet corn than they require, resulting in Southern Ontario's small surplus in this commodity. Norfolk, Middlesex, Elgin, and Chatham-Kent are the four largest contributors to the surplus.

Approximately 80% of Southern Ontario's dry onion requirements are supplied by local production, with the remainder shipped in from other provinces or countries. As with carrots, the southwest and the Outer Greater Golden Horseshoe generate surpluses — specifically, the counties of Simcoe, Chatham-Kent, Essex and Lambton. Within the Golden Horseshoe, York Region has a surplus, but this is overshadowed by the market requirements within the GTA.

The southwest region is the only region that is surplus in cabbage, with almost 10,000 tonnes of product for consumption elsewhere. Within this region, Norfolk, Oxford, Chatham Kent, Essex and Lambton have surplus production. Outside this region, only Simcoe County produces a surplus relative to consumption. The Southern Ontario cabbage deficit is 1.8 kg, with overall consumption at 5.4 kg/person. Imports make up most of the shortfall.

Southern Ontario produces almost enough green and wax beans to meet its consumption requirements. Surpluses are concentrated in a few counties in the southwest led by Chatham-Kent, Essex, Middlesex, Oxford and Elgin. Within the Greater Golden Horseshoe, Brant County and Hamilton have surplus production for consumption in nearby regions.

Southern Ontario runs a large deficit in potatoes, with 412,000 tonnes — more than half of consumption — coming from out-of-province suppliers. Potatoes are required for fresh consumption as well as for processed products such as fries and chips. The Outer Greater Golden Horseshoe has a surplus position, mostly due to production specialization in Simcoe and Brant Counties. Outside this region, only Bruce County has a surplus over local requirements.

Southern Ontario runs a large deficit in potatoes, with 412,000 tonnes — more than half of consumption — coming from out-of-province suppliers.

Food Surpluses and Deficits — Grain and Oilseed Crops

Southern Ontario produces enough grain and oilseed crops for human consumption requirements. This does not imply that all these requirements are met by local sources, since the varieties of crops currently grown may not entirely match the products typically consumed.

In the case of wheat, a surplus of 754,000 tonnes is generated across Southern Ontario. The Outer Greater Golden Horseshoe produces more than it requires, as does Southwestern Ontario. The Golden Horseshoe and Eastern Ontario do not produce enough wheat to meet local requirements. Ontario grows mostly soft wheat varieties, which are used in cookie and biscuit manufacturing. The province receives wheat from western Canada for use in certain bread products, with Ontario having production in these hard high-protein varieties as well.

Southern Ontario overall has a small surplus in oats, with small surpluses realized in almost every county. Any deficits are also small, aside from those in some parts of the Golden Horseshoe. Use of oats for food purposes is rather low at 2.1 kg/person. Most oat production is for the animal feed market.[20]

TABLE 8 → Grain and Oilseed Products Surplus/Deficit by Region in Southern Ontario (2010)

PRODUCT	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO	AVERAGE ONTARIO CONSUMPTION
WHEAT	KG/PERSON	-48.0	120.9	-15.2	570.3	-16.3	62.2	60.3
	1,000 TONNES	-336.4	204.1	-132.3	918.1	-29.6	754.0	
OATS	KG/PERSON	-1.1	8.4	0.8	9.9	4.3	2.4	2.1
	1,000 TONNES	-7.5	14.2	6.7	16.0	7.8	29.4	
BARLEY	KG/PERSON	2.5	34.7	8.8	47.7	17.5	15.2	0.1
	1,000 TONNES	17.6	58.5	76.1	76.7	31.7	184.2	
SOYBEAN OIL	KG/PERSON	43.7	479.0	522.7	3,023.8	155.4	184.7	5.5
	1,000 TONNES	19.0	67.9	86.9	329.9	53.9	456.7	

Most counties in Southern Ontario produce more barley than they consume. Human consumption of barley is under 0.1 kg/person, with most barley grown in Ontario going to animal feed. Barley is currently shipped into Ontario from western Canada for malting purposes.

Soybeans generate two products: soybean oil and soybean meal. The meal is high in protein and is used primarily for animal feed, with some specialized uses for human consumption. The oil, which is approximately 20% of the soybean, goes to manufacture products such as salad oil and margarine

Southern Ontario produces enough grain and oilseed crops for human consumption requirements; a surplus of 754,000 tonnes of wheat is generated.

Southern Ontario has deficits in beef, lamb and chicken, and surpluses in pork, turkey and eggs.

and is an ingredient in many food products. Based on per capita consumption of 5.5 kg of soybeans, each region of the province has more local production than required.

Food Surpluses and Deficits — Livestock and Poultry Products

In livestock and poultry products, Southern Ontario has deficits in beef, lamb and chicken, and surpluses in pork, turkey and eggs, as reported in Table 9.

The beef deficit in Southern Ontario at 11.1 kg/person is large, representing 18% of average consumption. The Outer Greater Golden Horseshoe and Southwestern Ontario produce more than enough beef for local requirements, but the regions to the east are short of beef. The largest surpluses are registered in Bruce, Huron, Grey and Perth Counties.[21]

In pork production, on the other hand, Southern Ontario has a large surplus — 9.6 kg/person compared to an average consumption of 49.2 kg/person. Farmers in Huron, Perth, Oxford, Middlesex and Lambton Counties generate most of Southern Ontario's surplus. Wellington, Waterloo and Haldimand are responsible for the surplus in the Outer Greater Golden Horseshoe. Ontario imports consumer-ready pork products and also exports pigs to the United States for finishing and for slaughter.

Lamb consumption in Southern Ontario exceeds the supply potential, with a deficit of 2,850 tonnes (0.2 kg/person). On a regional level, only the Golden Horseshoe is in deficit. The largest surpluses are in Huron, Grey, Bruce and Wellington Counties. Relatively large surpluses are also reported for Perth, Dufferin, and Kawartha Lakes.

Southern Ontario consumes more chicken than it produces, with a per person deficit of 4.2 kg (51,000 tonnes in all), which is just under 13% of typical consumption. Southwestern Ontario has a surplus in chicken, while the other regions fall short of requirements. The largest deficits are found near urban centres, though in the Golden Horseshoe Niagara has a rather large surplus of chicken. Huron, Wellington, Oxford and Perth Counties also have relatively large surpluses. Chicken is a supply-managed commodity, where production is designed to meet consumption. However, this national system has some anomalies, leaving Ontario's production below its share of population and the needs of Ontario processors.

Southern Ontario's production and consumption of turkey (another supply-managed commodity) result in a surplus of just under 9,000 tonnes, which is around 15% of consumption. The Golden Horseshoe and Eastern Ontario have deficits in turkey, with the area to the west in a surplus position. The three counties of Oxford, Huron and Middlesex have the largest turkey surpluses.

TABLE 9 → Livestock & Poultry Products Surplus/Deficit by Region in Southern Ontario (2010)

PRODUCT	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO	AVERAGE ONTARIO CONSUMP-TION
BEEF	KG/PERSON	-27.2	4.2	-21.1	40.7	-9.4	-11.1	63.4
	TONNES	-190,190	7,116	-183,074	65,342	-17,029	-134,761	
PORK	KG/PERSON	-22.1	12.0	-15.4	173.2	-15.6	9.6	49.2
	TONNES	-154,273	20,256	-134,017	278,302	-28,345	115,940	
LAMB	KG/PERSON	-1.0	0.9	-0.6	1.4	0.1	-0.2	2.4
	TONNES	-6,675	1,453	-5,222	2,208	163	-2,851	
CHICKEN	KG/PERSON	-23.7	25.2	-14.2	71.7	-23.6	-4.2	32.8
	TONNES	-165,860	42,480	-123,379	115,437	-42,929	-50,872	
TURKEY	KG/PERSON	-4.1	5.1	-2.3	23.2	-4.6	0.7	4.7
	TONNES	-29,011	8,677	-20,333	37,275	-8,300	8,642	
EGGS	DOZ/PERSON	-14.1	12.0	-9.1	44.8	13.9	1.5	16.1
	1,000 DOZ	-98,981	20,184	-78,797	72,134	25,180	18,517	

In egg production (also supply-managed), Southern Ontario shows a small surplus of nearly 10% over consumption needs. A few counties record large surpluses of eggs — such as Huron, Wellington, Lambton, and Perth in the southwest and Prescott and Leeds Grenville in the southeast. Smaller surpluses are found in Waterloo Region and Grey, Oxford, and Bruce Counties.

SECTION 4

Economic Impact of Southern Ontario's Food System

The food system represents an important pillar of Ontario's economy and this section examines several measures of the system's economic impact. Crop and animal agriculture, the upstream suppliers of farm inputs, food processing and manufacturing, and downstream distribution through food service and retail operations are basic building blocks of the system. The various components are tightly connected to one another and mutually interdependent. In particular, the existence of a viable food processing sector depends on a vibrant agricultural sector, and vice versa.

EMPLOYMENT IN FOOD SUPPLY CHAIN [22]

Employment in the overall agri-food sector (agriculture, food and beverage manufacturing, wholesaling and distribution, food services and food retailing) increased from 658,388 to 767,473 over the 2002 to 2013 period, a 16% increase. This reflects an annual growth rate of 1.4%, which is slightly more than population growth.

Employment in the overall agri-food sector increased 16% between 2002 & 2013. This reflects an annual growth rate of 1.4%, which is slightly more than population growth.

In 2013, agricultural production in the Ontario farm sector provided employment for 86,800 individuals. Employment in crop and animal agriculture occurs only in rural areas, where alternative opportunities are limited; contributions of agriculture to rural employment are crucial for sustaining rural populations and communities.

The food, beverage and tobacco manufacturing sector accounted for another 96,779 jobs for a combined employment of 183,579 people. Wholesaling and distribution within the agri-food supply chain accounted for a further 47,465 jobs, while food service and food retailing provided 535,494 jobs. Together, all these areas of the broad agri-food sector generated total employment of 767,473 reported[23] for 2013, as noted above. This level of employment accounted for 11.2% of Ontario's paid labour force.

Statistics Canada compiles employment data in various types of industries on a county basis[24], which can be used to provide an overview of employment in crop and animal agriculture in each Ontario region. The largest direct employment in the farm sector is found in Southwestern Ontario, where crop and animal agriculture employed an estimated 35,900 individuals in 2013, representing 43% of all farm sector employment in Southern Ontario (see Table 10).[25] The Greater Golden Horseshoe also employs 36,000 people, representing 42% of direct farm employment.

The majority of food processing and manufacturing activity is located within the GTA, with the Golden Horseshoe accounting for 61% of direct employment in food processing and manufacturing in Southern Ontario.[26] This is followed by the Outer Greater Golden Horseshoe at 17%. In all, the Greater Golden Horseshoe accounts for 74,800 jobs or 78% of all food processing and manufacturing employment in Southern Ontario.

TABLE 10 → Employment in Agriculture and Food Manufacturing, Southern Ontario (2013)

		GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
AGRICULTURE EMPLOYMENT	#	17,200	18,800	35,900	12,300	84,300
	%	20%	22%	43%	15%	100%
FOOD MANUFACTURING	#	58,500	16,300	14,600	6,300	95,700
EMPLOYMENT	%	61%	17%	15%	7%	100%

VALUE ADDED IN FOOD SUPPLY CHAIN

Employment is one direct measure of economic importance; GDP is another. When only primary agriculture is taken into account, the contribution to Ontario's total real GDP[27] has been on average less than 1% (0.74%).[28] When food, beverage and tobacco manufacturing is added to primary agriculture, the combined contribution of $16.3 billion[29] represents more than 2.8% of Ontario GDP. Over the 2007-2013 period, a much higher share of Ontario GDP (6%) is linked with the food system as a whole, including the food services sector (e.g., restaurants) and food retail (e.g., grocery stores); the value of this GDP was $34.8 billion in 2013 (in inflation-adjusted dollars).

AGRICULTURE'S CONTRIBUTION TO ONTARIO'S ECONOMY

The multiplier of 2.24 indicates that for every dollar spent initially by the farm sector, a total of $2.24 circulates throughout the economy.

The economic contribution of crop and animal agriculture is understated by the measures of direct farm sector employment and GDP. Like the provincial economy, the farm economy is comprised of complex, interacting sectors. Focusing only on the direct contribution of the farm sector results in a truncated and limited view of its full impact on the economy. The economic contribution of a sector such as agriculture is driven by its expenditures on purchases from upstream sectors in the economy (i.e., input suppliers). For example, the farm economy directly obtains goods and services from various sectors, such as animal feed from feed manufacturers, crop inputs from local dealers, electricity and fuels from energy suppliers, and professional services ranging from veterinarians to accountants.

A more comprehensive view of the economic contribution of farming comes from calculating the direct, indirect and induced impact of expenditures made by farmers. This study has measured this contribution by running a regional impact model (an input-output model),[30] based on 2011 values. This modeling approach captures how expenditures by farmers to produce a dollar's worth of farm products circulate and re-circulate within the economy, multiplying the effects of the original expenditures on overall economic activity.

A few definitions will be helpful:

- Direct impact — refers to farmers' initial expenditures on equipment, materials and labour — that is, their direct costs of operation.
- Indirect impact — refers to purchases by suppliers in the course of providing the goods and services required by farmers.
- Induced impact — refers to the re-spending of income on consumer goods and services by farmers and workers in the sectors receiving the initial and indirect expenditures.

Farmers' initial expenditures of $13.1 billion contribute to $29.3 billion in transactions (*gross output*, sales or economic activity) throughout Southern Ontario (Table 11 and Figure 3), which includes all direct, indirect

TABLE 11 → Province Wide Economic Impact of Agriculture in Southern Ontario (2011)[31]

ITEM		UNITS	SOUTHERN ONTARIO
INITIAL EXPENDITURE		$ BILLION	$13.1
GROSS OUTPUT			
	DIRECT	$ BILLION	$7.8
	INDIRECT & INDUCED	$ BILLION	$21.5
	TOTAL	$ BILLION	$29.3
	MULTIPLIER		2.24
GDP			
	DIRECT	$ BILLION	$7.5
	INDIRECT & INDUCED	$ BILLION	$7.7
	TOTAL	$ BILLION	$15.1
	MULTIPLIER		1.16
WAGES & SALARIES			
	DIRECT	$ BILLION	$4.3
	INDIRECT & INDUCED	$ BILLION	$4.6
	TOTAL	$ BILLION	$8.9
EMPLOYMENT			
	DIRECT	#	114,978
	INDIRECT & INDUCED	#	98,841
	TOTAL	#	213,818
	MULTIPLIER		1.86
TAXES			
	FEDERAL	$ BILLION	$2.4
	PROVINCIAL	$ BILLION	$1.5
	LOCAL	$ BILLION	$0.5
	TOTAL	$ BILLION	$4.4
IMPORTS			
	FROM OTHER PROVINCES	$ BILLION	$2.2
	FROM OTHER COUNTRIES	$ BILLION	$1.1
	TOTAL	$ BILLION	$3.3

Economic activity driven by farm sector production sustains 214,100 FTE jobs across Ontario, with an expenditure on wages and salaries of $8.9 billion.

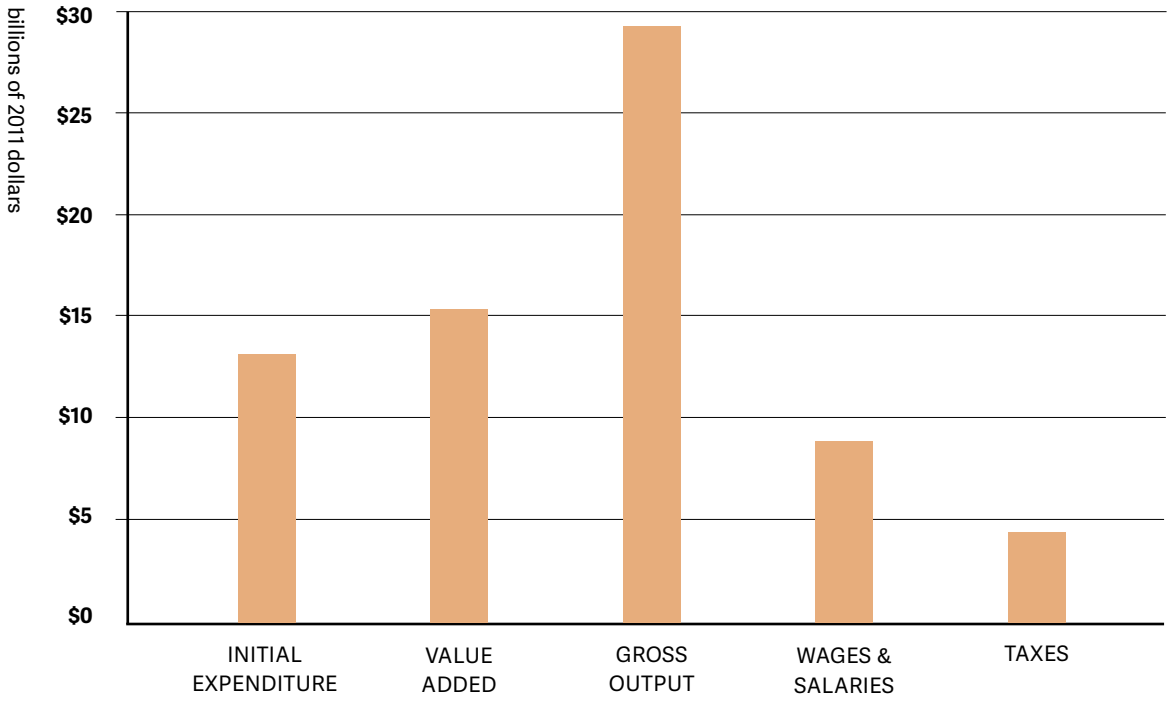
and induced expenditures as well as double counts impacts. The gross output multiplier of 2.24 indicates that for every dollar spent initially by the farm sector, a total $2.24 is transacted throughout the economy.[32] This level of gross output resulted in an overall level of GDP of $15.1 billion (a measure of net output) after adding together the direct, indirect and induced impacts. This $15.1 billion is at least 2.5% of provincial GDP and has a multiplier value of 1.16, where one dollar spent initially by the farm sector generates an additional $0.16 in GDP.

The agricultural sector directly creates 115,100 full-time equivalent (FTE) jobs for Ontarians. This *employment* volume exceeds the level in all public administration in the province (at 93,100) as well as in the utility sector (at 46,300) and the entire fish, forestry, mining, quarrying and oil and gas extraction sector (at 42,300). It far surpasses Ontario's forestry and logging sector (at 14,600).

Considering also the indirect and induced effects, economic activity driven by farm sector production sustains 214,100 FTE jobs across Ontario, with an expenditure on wages and salaries of $8.9 billion.[33] Together, these jobs represent just over 3% of all Ontario-wide full and part time paid employment.

The employment impacts of agriculture are widely distributed and affect many sectors that are not directly related to agriculture (Figure 4). Service sectors are major beneficiaries through the indirect and induced multiplier effects. Trade, finance, insurance, real estate and business and computer

FIGURE 3 → Summary of Province Wide Economic Impacts of Agriculture (2011)



services reflect large employment impacts as they sustain farm operations and as farmers and consumers spend their incomes. The chemicals and fertilizer-producing sectors show relatively high employment impacts as does the transportation sector.

The total economic activity throughout the province due to farmers' expenditures contributes to *tax revenues* collected by all three levels of government. A total of $4.4 billion in tax revenue was generated, with $2.4 billion received by the federal government, $1.5 billion by the provincial government and $0.5 billion by local governments. Personal income taxes account for the largest share of tax revenues for both the federal and provincial governments, while property taxes are the main source of local government tax revenues arising from farm output (Figure 5).

A total of $4.4 billion in tax revenue was generated from farmers expenditures.

FIGURE 4 → Province Wide Employment Impacts of Agriculture (2011)

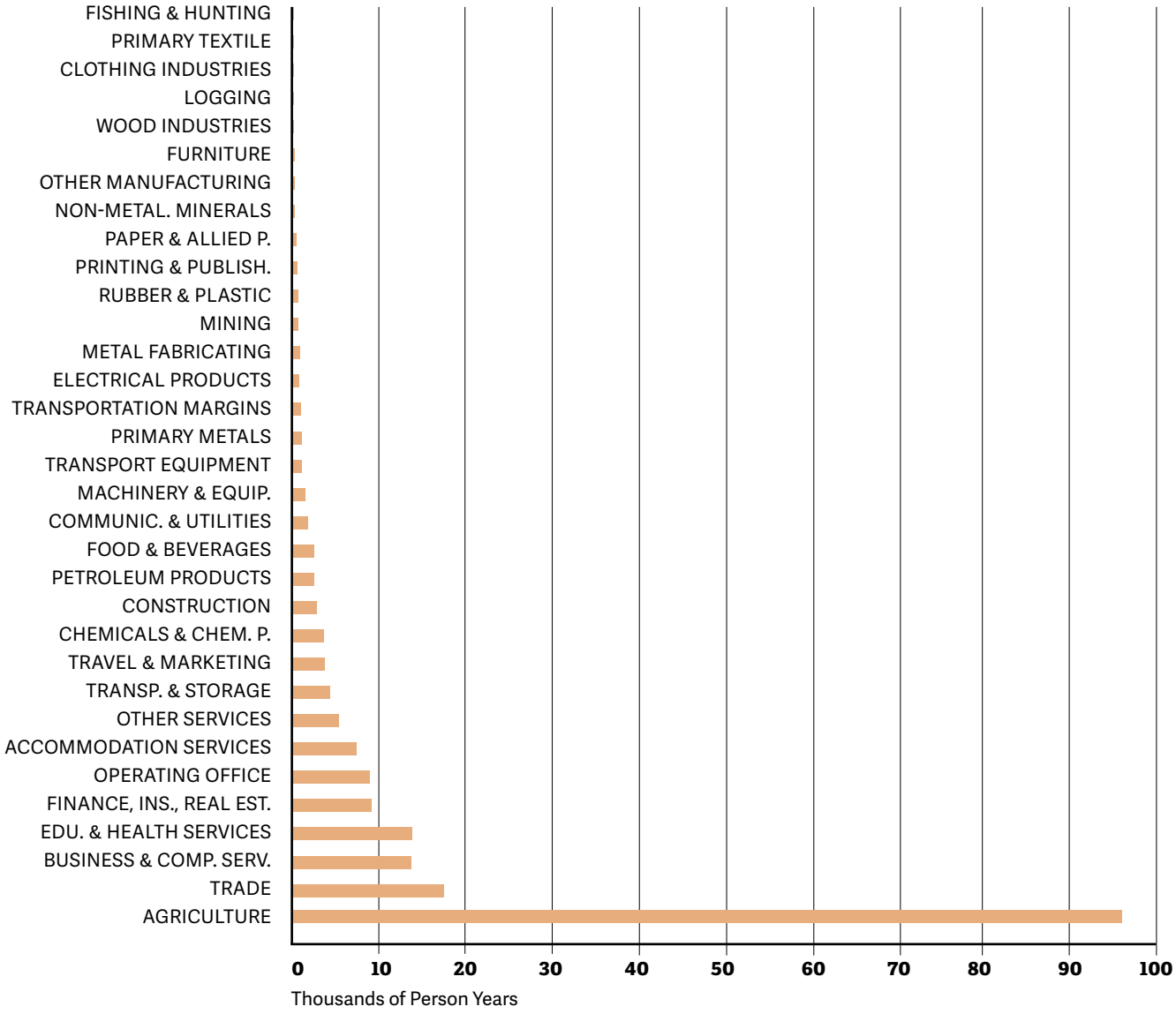


FIGURE 5 → Province Wide Tax Impacts of Agriculture (2011)

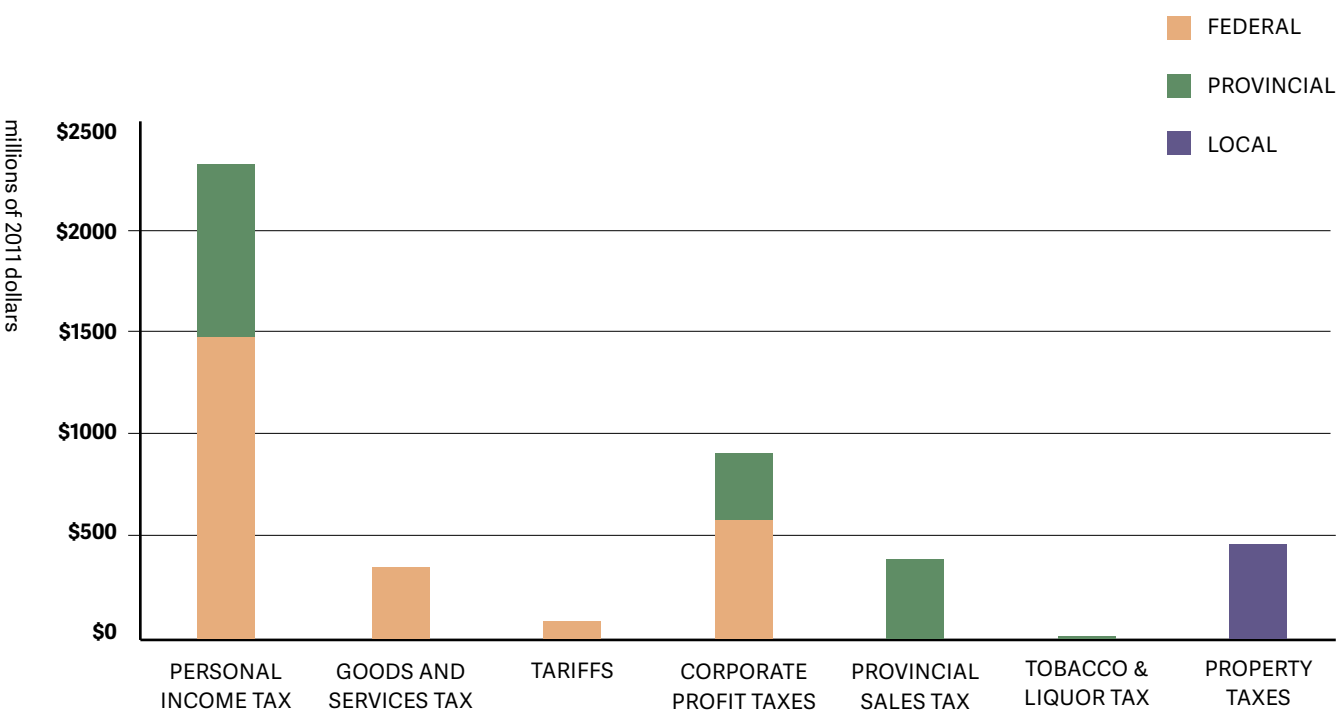


TABLE 12 → Economic Contribution of Farming by Region — Gross Output and GDP (2011)

ITEM	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
INITIAL EXPENDITURE	$ MILLION	$2,079	$2,662	$4,741	$6,735	$1,581	$13,058
DISTRIBUTION	**%**	**16%**	**20%**	**36%**	**52%**	**12%**	**100%**
GROSS OUTPUT							
DIRECT	$ MILLION	$1,037	$1,647	$2,683	$4,120	$951	$7,755
INDIRECT & INDUCED	$ MILLION	$3,851	$4,303	$8,155	$10,811	$2,533	$21,499
TOTAL	$ MILLION	$4,888	$5,950	$10,838	$14,932	$3,484	$29,254
DISTRIBUTION	**%**	**17%**	**20%**	**37%**	**51%**	**12%**	**100%**
MULTIPLIER		2.35	2.24	2.29	2.22	2.20	2.24
GDP							
DIRECT	$ MILLION	$1,297	$1,486	$2,783	$3,796	$901	$7,480
INDIRECT & INDUCED	$ MILLION	$1,352	$1,544	$2,897	$3,856	$898	$7,650
TOTAL	$ MILLION	$2,649	$3,030	$5,679	$7,652	$1,798	$15,130
DISTRIBUTION	**%**	**18%**	**20%**	**38%**	**51%**	**12%**	**100%**
MULTIPLIER		1.27	1.14	1.20	1.14	1.14	1.16

AGRICULTURE'S CONTRIBUTION TO ONTARIO'S ECONOMY BY REGION

The output and economic contribution of the farm sector is greater in some regions than others due to the location of crop and animal agriculture across Southern Ontario.[34] The initial expenditures made by the farm sector are largest in Southwestern Ontario at $6.7 billion, which represents 52% of all farm expenditures in Southern Ontario (See Table 12). As a result, the southwest accounts for 51% of the GDP throughout the economy due to farming.

The Greater Golden Horseshoe accounts for gross output of $10.8 billion or 37% of the total in the economy that is attributed to farming. The resulting GDP is 38% of the Southern Ontario level, or $5.7 billion.

A significant difference can be noted for the value added multiplier for agriculture between the Golden Horseshoe at 1.27 and 1.14 in other regions. This may be due to proximity to the industrial and commercial activities within the GTA. As reported in Annex 1, this multiplier is highest in Halton at 1.33 and York at 1.29. More diversified economies have a greater likelihood of boosting the economic impacts of agriculture. Agriculture in Eastern Ontario accounts for 12% of the economic impact across the province, with gross output at $3.5 billion and resulting GDP at $1.8 billion.

The gross output in the economy due to agriculture creates the employment opportunities associated with farming. The Golden Horseshoe accounts for 42,000 FTE jobs and $1.7 billion in wages and salaries (see Table 13). Comparable employment impacts occurred in the Outer Greater Golden Horseshoe, even though output in the Golden Horseshoe was less. This reflects the nature of crop agriculture in the Golden Horseshoe, with horticulture there more labour-intensive than most other types of farming.

TABLE 13 → Economic Contribution of Farming by Region — Employment (2011)

ITEM	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
WAGES & SALARIES							
DIRECT	$ MILLION	$918	$817	$1,735	$2,052	$484	$4,270
INDIRECT & INDUCED	$ MILLION	$814	$929	$1,743	$2,320	$541	$4,604
TOTAL	$ MILLION	$1,732	$1,746	$3,478	$4,372	$1,025	$8,875
DISTRIBUTION	**%**	**20%**	**20%**	**39%**	**49%**	**12%**	**100%**
EMPLOYMENT							
DIRECT	#	24,648	22,132	$46,780	55,489	12,709	114,978
INDIRECT & INDUCED	#	17,364	20,065	$37,429	49,864	11,548	98,841
TOTAL	#	42,012	42,197	$84,209	105,352	24,257	213,818
DISTRIBUTION	**%**	**20%**	**20%**	**39%**	**49%**	**11%**	**100%**
MULTIPLIER		1.70	1.91	1.80	1.90	1.91	1.86

In Southwestern Ontario, 105,400 FTE jobs are sustained by the farm sector. This includes 35,900 on-farm employees, as noted above in Table 10, with the remaining jobs off the farm. This sizable employment base represents 14% of the paid labour force in the region.[35] Crop and animal agriculture contributes to an overall employment level of 24,257 individuals in Eastern Ontario.

The province-wide employment multiplier is 1.86, suggesting that for every direct job generated by farm operating expenditures, another 0.86 full-time equivalent jobs were generated by the indirect and induced effects.[36] This value is lower in the Golden Horseshoe, again likely reflecting the labour intensity of agriculture there.

Within the Greater Golden Horseshoe, $1.7 billion in tax revenue is captured by all three levels of government from the economic activity sustained by farm output (Table 14). In the southwestern region, where a large part of Ontario agricultural output occurs, $2.2 billion in tax revenues flow to all levels of government from the economic activity driven by farming.

TABLE 14 → Economic Contribution of Farming by Region — Taxes Received and Imports (2011)

ITEM	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
TAXES							
FEDERAL	$ MILLION	$432	$478	$910	$1,206	$284	$2,400
PROVINCIAL	$ MILLION	$275	$305	$580	$779	$184	$1,544
LOCAL	$ MILLION	$82	$91	$173	$233	$55	$461
TOTAL	$ MILLION	$790	$874	$1,664	$2,218	$523	$4,405
DISTRIBUTION	**%**	**18%**	**20%**	**38%**	**50%**	**12%**	**100%**
IMPORTS							
FROM OTHER PROVINCES	$ MILLION	$376	$447	$822	$1,119	$262	$2,203
FROM OTHER COUNTRIES	$ MILLION	$192	$232	$424	$579	$133	$1,136
TOTAL	$ MILLION	$567	$679	$1,246	$1,698	$395	$3,339

The economic activity sustained by farming requires goods and services from outside Ontario, valued at $3.3 billion as reported in Table 14. For example, $376 million was shipped into the Golden Horseshoe from other provinces, and $192 million was imported from other countries.

The following provides some highlights of farming's economic impact by region in Southern Ontario.[37]

For every direct job generated by farm operating expenditures, another 0.86 full-time equivalent jobs were generated by the indirect and induced effects.

Southwestern Ontario Impacts

- A total of 105,352 FTE jobs are sustained across Ontario by farm operating expenditures in Southwestern Ontario. This employment impact is sustained by a level of gross output that exceeded $14.9 billion.
- Farm operating expenditures in Southwestern Ontario are credited with supporting GDP of about $7.6 billion, of which wages and salaries accounted for about $4.4 billion.[38]
- Essex County leads Southern Ontario in generating GDP (at $1.2 billion). Huron County comes in at $1 billion. This difference between the two counties occurs even though initial expenditures in Essex are only 4% higher than in Huron, reflecting the higher multiplier in Essex (of 1.26) compared to Huron (at 1.08). The higher level can be attributed to the greenhouse sector. As well, direct wages in Essex are $431 million or 90% higher than $226 million in Huron.
- Apart from Niagara, the only areas in Ontario that contribute to employment impacts over 10,000 are found in the southwest and include Essex (at 18,487), Huron (13,349), Oxford (11,066), Perth (10,875), and Middlesex (10,396). Grey County comes in lowest in the southwest (at 5,233).

Outer Greater Golden Horseshoe Impacts

- Province-wide employment due to farming in this region is 42,197, with Wellington County contributing the most at 9,500 FTE jobs. Crop and animal agriculture in the Outer Greater Golden Horseshoe creates wages and salaries of $1.7 billion.
- The GDP resulting from farming in the region totals $3 billion — including $743 million due to Wellington County. The GDP multiplier is much higher in Haldimand County, reflecting the nature of agricultural production there.
- Initial expenditures are largest in Wellington at $688 million, which represents 26% of the region's total, followed by Waterloo at $511 million. This reflects the livestock and poultry base in these two areas.
- Gross output of $1.5 billion is attributed to farming in Wellington; the comparable figure for Waterloo is $1.1 billion.

Golden Horseshoe Impacts

- Niagara Region accounts for 43% of initial expenditures in the Golden Horseshoe, driven by the large horticultural base.
- Gross output of $2.1 billion is driven by agricultural production in Niagara, followed by $743 million for each of Durham and York.
- Gross output multipliers are higher in this region (averaging 2.35) than in the rest of Southern Ontario, reflecting the nature of agriculture in the Golden Horseshoe. Value added multipliers are also significantly higher in this region (average of 1.27) compared to elsewhere in the province.

- Province-wide GDP generated by agriculture in Niagara exceeds $1.1 billion — second only to Essex County — followed by York at $406 million.
- Of areas in the Golden Horseshoe, Niagara has the largest employment impact at 18,400 FTE jobs (and $745 million in wages and salaries), followed by Hamilton at 6,850 jobs.
- The tax impact is $790 million for the Golden Horseshoe, with Niagara generating 43% of this at $336 million.

Eastern Ontario Impacts

- A total of 24,257 FTE jobs are sustained in Ontario due to farm operating expenditures in the southeast region. This employment impact is supported by gross output of $3.5 billion.
- Farm operating expenditures in Eastern Ontario are credited with generating GDP of $1.8 billion, of which wages and salaries accounts for about $1 billion.[39]
- All levels of government derive revenues from these impacts. The total revenue collected is over $523 million — with the federal government's share at $284 million, the provincial government's at $184 million and local governments' at $5 million.
- The largest GDP impacts are made by Stormont Dundas and Glengarry ($448 million), Prescott Russell ($335 million), Ottawa ($280 million), and Leeds Grenville ($169 million. The employment impacts are largest in Stormont (5,725 FTE jobs) and Prescott (with 4,184).

ECONOMIC CONTRIBUTION OF FOOD PROCESSING AND MANUFACTURING

Ontario's food and beverage manufacturing sector is a pivotal one for the economy, making a substantial contribution to income, employment, taxes and exports. It maintains a web of extensive linkages, backward and forward, with many other sectors. The range is wide and deep, reaching from crop and animal agriculture to metal fabricating to transportation to other services. In 2013, food processing and manufacturing accounted for 16% of all manufacturing activity in the province (in terms of GDP) with 97,000 employees. The importance of food processing to the overall manufacturing economy has been increasing over the last few years. The size and scope of the food manufacturing sector suggests that its health and sustainability are critical to the strength and productivity of the entire Ontario economy — particularly those sectors closely linked to its operations.

Just as with farming, the total contribution of food manufacturing to Ontario's economy is often underrepresented when only direct impacts are considered. It should be noted that the economic impacts arising from food manufacturing include the economic contribution of farm products used by processors and manufacturers.

TABLE 15 → Province Wide Economic Impact of Ontario Food Manufacturing (2011)

ITEM	UNITS	FOOD MANUFACTURING IMPACT
INITIAL EXPENDITURE	$ BILLION	$21.7
GROSS OUTPUT		
DIRECT	$ BILLION	$17.0
INDIRECT & INDUCED	$ BILLION	$36.7
TOTAL	$ BILLION	$53.7
MULTIPLIER		2.47
GDP		
DIRECT	$ BILLION	$15.1
INDIRECT & INDUCED	$ BILLION	$6.3
TOTAL	$ BILLION	$21.3
MULTIPLIER		0.98
WAGES & SALARIES		
DIRECT	$ BILLION	$4.4
INDIRECT & INDUCED	$ BILLION	$8.0
TOTAL	$ BILLION	$12.4
EMPLOYMENT		
DIRECT	#	87,758
INDIRECT & INDUCED	#	185,701
TOTAL	#	273,458
MULTIPLIER		3.12
TAXES		
FEDERAL	$ BILLION	$3.7
PROVINCIAL	$ BILLION	$2.5
LOCAL	$ BILLION	$0.7
TOTAL	$ BILLION	$6.9
IMPORTS		
FROM OTHER PROVINCES	$ BILLION	$4.3
FROM OTHER COUNTRIES	$ BILLION	$2.9
TOTAL	$ BILLION	$7.2

Farm producers are upstream suppliers that receive some of the initial expenditures made by food manufacturers.

The overall economic impacts of Ontario food manufacturing include the following:

- The operations of the food manufacturing sector sustain a total of 273,500 FTE jobs in the province or 4% of overall Ontario employment.
- These jobs are supported by high expenditures across the province on agricultural inputs, labour, energy, and other supplies that exceeded $53.7 billion.

- The effective wages[40] and salaries sustained by these expenditures are relatively high. The direct effective wage per annum is over $50,902 and the total effective wage across all sectors affected by food manufacturing is $45,440.
- When direct, indirect and induced effects are combined, the GDP impact of food manufacturing in Ontario totals $21.3 billion.
- All levels of government derive large streams of revenues from the economic impacts of food manufacturing. The total tax revenues of all three levels of government exceeded $6.9 billion — with the federal government collecting $3.7 billion, the provincial government capturing $2.5 billion and local governments $745 million.

SECTION 5

Environmental Impact of Southern Ontario's Food System

The production of food, starting with crop and animal agriculture and ending with consumer-ready manufactured food products, has an environmental impact. Currently, there are no standardized and generally accepted environmental indicators that adequately capture the environmental impacts of farming and food manufacturing.

The following analysis uses a set of indicators to represent the nature and magnitude of these impacts in Ontario. These indicators are estimated for agriculture in Southern Ontario, as shown in Table 16, based on an extension of the economic impact model and the linkages to input suppliers[41] that were used to capture the economic contribution of agriculture.[42] The specific environmental indicators generated by the model include: water demand/balances, air emissions/pollutants, energy demands, greenhouse gases, solid waste, contaminants, and green GDP.[43, 44]

The environmental impacts encompass more than those that may occur on the farm and are modelled through the economic linkages that support agricultural production. For example, the environmental impacts from supplying feed to a livestock or poultry operation are included, such as those from transportation, manufacturing of necessary machinery and trucks, and the operations of the goods and services providers to these equipment manufacturers. All of the environmental impacts linked to the direct, indirect and induced economic effects of agriculture are accounted for in the values reported in Table 16. This is why, for example, diaper waste is reported. This item is a result of the multiplier effect and reflects the household activity across Ontario that is directly or indirectly supported by expenditures originating in the agricultural sector.

Agricultural production generates large amounts of emissions but levels are generally far below those of industrial activities.

AGRICULTURE'S ENVIRONMENTAL IMPACT IN CONTEXT

The water intake connected with agriculture in Southern Ontario totals 8.9 billion cubic metres per year, with a net usage of only 99 million cubic metres (after accounting for discharges). The intake figure refers to metered water based on all direct, indirect and induced economic activities due to farming.[45] The level for agriculture is relatively high when compared to industrial and residential uses.

Agricultural production generates large amounts of emissions — particularly volatile organic compounds, sulphur oxides and carbon monoxide — but levels are generally far below those of industrial activities.

Total direct, indirect and induced energy consumption comes to nearly 262,000 terajoules.[46] To put this in proportion, in 2007, Ontario households directly consumed a total of 515,000 terajoules. Crude oil is the dominant energy source for the economic activities associated with agriculture (at 117,000 terajoules), followed by natural gas (65,000 terajoules).

In terms of greenhouse gases, CO_2 is the most prominent, with activities supporting agricultural production generating 14.2 million tonnes. This is

followed by 15,000 tonnes of methane and 20,000 tonnes of nitrous oxide. In comparison, the iron and steel industry on its own (without indirect or induced effects) produces 11.1 million tonnes of CO2, petroleum refining 6 million tonnes and mining 1.1 million tonnes.

Economic activities supporting agricultural output also generate waste. A total of 509,000 tonnes of solid waste are attributable to agriculture. The largest contributor is wood waste (at 137,000 tonnes), followed by all forms of food waste (46,000 tonnes), old corrugated containers or OCC (42,000 tonnes), and fine paper (34,000 tonnes). To put this in context, all

FIGURE 16 → Province Wide Environmental Impact of Agriculture in Southern Ontario (2011)

DEMAND FOR WATER	MCM
INTAKE	8,851
DISCHARGE	8,752
NET USAGE	99
AIR EMISSIONS	**TONNES**
PARTICULATES	9,142
SULPHUR OXIDES	23,639
NITROGEN OXIDE	7,198
VOLATILE ORGANIC C	43,626
CARBON MONOXIDE	25,862
ENERGY USED	**TERAJOULES**
COAL	43,069
CRUDE OIL	117,146
NATURAL GAS	64,597
ELECTRICITY	26,456
NUCLEAR STEAM	10,514
TOTAL	261,782
GREENHOUSE GASES	**TONNES**
CARBON DIOXIDE	14,226,773
METHANE	15,467
NITROUS OXIDE	20,383
GREEN GDP	**$ MILLION**
GDP	$15,146
GREEN COST	$1,000
GREEN GDP	$14,146
PERCENT OF GDP	93.4%

WASTE GENERATED	TONNES
ONP	16,326
FINE PAPER	34,183
BOXBOARD	31,632
OCC	41,836
MIXED PAPER	7,653
MAGAZINES	12,245
TEL. BOOKS	510
GLASS CONT.	5,612
PLASTIC	9,694
ALUMIN. CANS	1,531
TINPLATE	2,551
USED TIRES	8,163
YARD WASTE	10,714
FOOD WASTE	46,428
WOOD WASTE	137,242
DEMOL. WASTE	12,245
DIAPERS	510
FOUNDRY SAND	33,673
OTHER	96,427
TOTAL	509,174
CONTAMINANTS	**TONNES**
AMMONIA-N	245
OIL & GREASE	196.9
TSS	3,402.1
PHOSPHORUS	29.3
CYANIDE	6.5
PHENOLICS	3.6
COPPER	2.6
LEAD	4.9
ZINC	17.7
TOTAL	3,908

manufacturing (without indirect or induced effects) generates 1.7 million tonnes of solid waste while the retail sector on its own accounts for 950,000.

The economic activity associated with agricultural production also results in contaminants that require disposal. Total suspended solids (TSS) are the highest-volume contaminant produced by agriculture in Southern Ontario at 3,400 tonnes. Ammonia-N was second (at 245 tonnes), followed by oil and grease (197 tonnes).

ENVIRONMENTAL IMPACT OF AGRICULTURE — BY REGION

The environmental impacts across the four regions are presented in Table 17.[47] The impact is roughly proportional to the value of farm output in the region. For example, compare the carbon monoxide share for the Golden

TABLE 17 → Environmental Impact of Agriculture by Region (2011)

	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTHWEST ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
DEMAND FOR WATER (MCM)						
INTAKE	1,431	1,820	3,250	4,441	1,160	8,851
DISCHARGE	1,415	1,799	3,214	4,391	1,147	8,752
AIR EMISSIONS (TONNES)						
PARTICULATES	1,364	1,901	3,265	4,803	1,074	9,142
SULPHUR OXIDES	3,796	4,640	8,435	12,218	2,985	23,639
NITROGEN OXIDE	1,154	1,429	2,583	3,700	916	7,198
VOLATILE ORGANIC C	6,562	8,530	15,092	23,130	5,404	43,626
CARBON MONOXIDE	4,050	5,230	9,280	13,262	3,320	25,862
DISTRIBUTION	16%	20%	36%	51%	13%	100%
ENERGY USED (TERAJOULES)						
TOTAL	42,518	52,065	94,583	135,285	31,915	261,782
GREENHOUSE GASES (TONNES)						
CARBON DIOXIDE	2,255,828	2,818,782	5,074,610	7,397,426	1,754,737	14,226,773
METHANE	2,451	3,076	5,527	8,037	1,903	15,467
NITROUS OXIDE	3,229	4,077	7,306	10,577	2,500	20,383
GREEN GDP ('000 DOLLARS)						
GDP	$2,649	$3,040	$5,689	$7,642	$1,815	$15,146
GREEN COST	$157	$199	$355	$521	$123	$1,000
GREEN GDP	$2,492	$2,841	$5,334	$7,121	$1,691	$14,146
PERCENT OF GDP	94.1%	93.5%	93.8%	93.2%	93.2%	93.4%
WASTE GENERATED (TONNES)						
TOTAL	82,818	105,820	188,638	259,832	60,704	509,174
DISTRIBUTION	16%	21%	37%	51%	12%	100%
CONTAMINANTS (TONNES)						
TOTAL	589.0	776.5	1,365.5	2,058.0	484.4	3,908.0

Horseshoe at 16% with its share of agricultural output at 15% (see Table 1) or its share of gross output at 17% (see Table 12). The southwest region has the highest level of farm output with just above 50%, which results in this region having the largest values for environmental impact due to agricultural production (also just over 50%).

ENVIRONMENTAL IMPACT OF FOOD MANUFACTURING

Compared to agriculture, food manufacturing-related activities create fewer air emissions but consume more energy, demand more water, and produce more solid waste and contaminants.

The model employed to show the economic impact of food manufacturing throughout the province — including the direct, indirect and induced effects — also provided the framework for estimating the sector's environmental impact. The results are shown in Table 18. As was the case with the economic impact, some of the environmental impact of food manufacturing comes from farm products supplied as inputs to manufacturers and processors.

Compared to agriculture-related activities, food manufacturing-related activities create fewer air emissions but consume somewhat more energy, demand more water, and produce more solid waste and contaminants. The relatively lower emissions associated with manufacturing are because the largest backward linkages of food manufacturing (other than agriculture) are trade, finance, insurance, and marketing which all have low emission impacts.

Key indicators are as follows:

- Water intake by economy-wide activities supporting food manufacturing totals 9.3 billion cubic metres — slightly larger than agriculture's intake of 8.9 billion cubic metres — with net water usage of 115 million cubic metres exceeding agriculture's 99 million cubic metres.
- Total energy use supporting food manufacturing activities is 304,000 terajoules, with natural gas accounting for the largest share at 119,000 terajoules. The energy total for agriculture is estimated to be 14% lower, with crude oil utilized more than natural gas in agriculture.
- Total air emissions are 25% lower than generated by agricultural production, with activities supporting food manufacturing responsible for 26,000 tonnes of VOC, 25,000 tonnes of carbon monoxide and 19,000 tonnes of sulphur oxide.
- The food manufacturing sector produces almost three times as much solid waste (1.4 billion tonnes) as the agricultural sector. Wood waste is the largest category at 380,000 tonnes. Food waste — which occurs in processing activities as well as in other parts of the economy — is next at 129,000 tonnes, followed by OCC at 115,830 tonnes.

There is a distinct difference between the contaminants generated by food manufacturing and those arising from agricultural production. Total suspended solids at 6,400 tonnes for the food manufacturing sector are almost double the level for agriculture. The food manufacturing sector produces slightly less ammonia-N and oil and grease but more phosphorous.

FIGURE 18 → Province Wide Environmental Impact of Ontario Food Manufacturing (2011)

DEMAND FOR WATER	MCM
INTAKE	9,328
DISCHARGE	9,213
NET USAGE	**115**
AIR EMISSIONS	**TONNES**
PARTICULATES	7,133
SULPHUR OXIDES	18,649
NITROGEN OXIDE	6,024
VOLATILE ORGANIC C	25,951
CARBON MONOXIDE	24,833
ENERGY USED	**TERAJOULES**
COAL	69,998
CRUDE OIL	62,760
NATURAL GAS	118,561
ELECTRICITY	43,921
NUCLEAR STEAM	8,497
TOTAL	**303,737**
GREENHOUSE GASES	**TONNES**
CARBON DIOXIDE	14,823,281
METHANE	18,407
NITROUS OXIDE	24,715
GREEN GDP	**$ MILLION**
GDP	$21,345
GREEN COST	$1,090
GREEN GDP	$20,255
PERCENT OF GDP	94.9%

WASTE GENERATED	TONNES
ONP	45,202
FINE PAPER	94,641
BOXBOARD	87,579
OCC	115,830
MIXED PAPER	21,188
MAGAZINES	33,901
TEL. BOOKS	1,413
GLASS CONT.	15,538
PLASTIC	26,839
ALUMIN. CANS	4,238
TINPLATE	7,063
USED TIRES	22,601
YARD WASTE	29,664
FOOD WASTE	128,543
WOOD WASTE	379,978
DEMOL. WASTE	33,901
DIAPERS	1,413
FOUNDRY SAND	93,229
OTHER	266,973
TOTAL	**1,409,733**
CONTAMINANTS	**TONNES**
AMMONIA-N	216.0
OIL & GREASE	164.3
TSS	6,424.6
PHOSPHORUS	44.9
CYANIDE	6.8
PHENOLICS	5.3
COPPER	2.1
LEAD	2.8
ZINC	31.3
TOTAL	**6,898**

TRANSPORTATION OF FOOD — ENVIRONMENTAL IMPACT

The above analysis that estimated the environmental impacts driven by farming and food manufacturing took into account all of the linkages[48] within the economy. Transportation of agricultural products from areas of surplus to areas where not enough is produced for local needs is a part of the Ontario food system. When more food is produced locally, transportation requirements decrease, and accordingly the environmental impact from transporting food products between regions also diminishes. The study performed an analysis of traffic pollutant emissions to provide

an estimate of the current environmental impact associated with transporting agricultural products.[49]

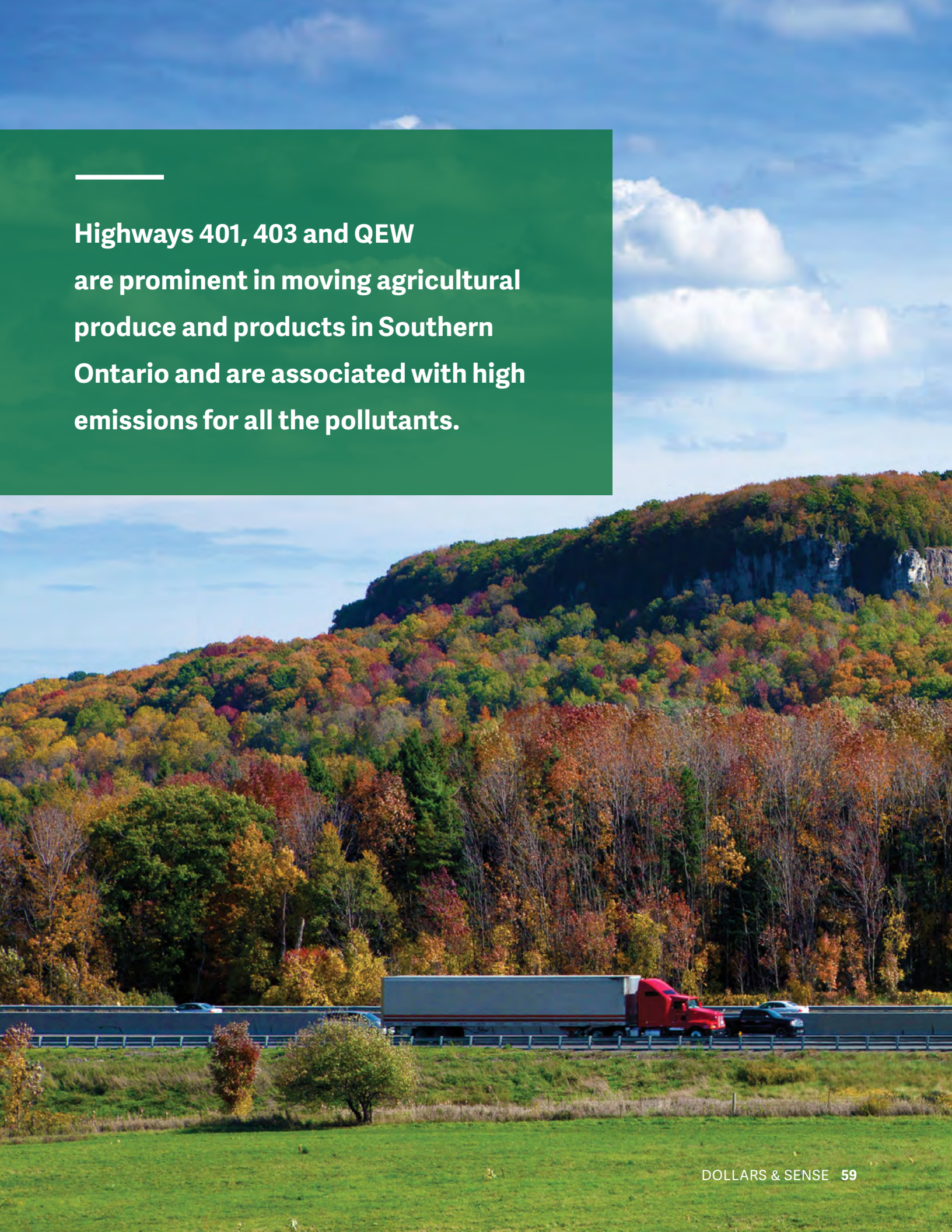
The basis for this analysis is county-level food production/consumption balances by commodity[50] and movement of product from surplus regions to deficit regions and into the export market,[51] as well as movement of imports. The study did not include transportation in the food processing sector, so the analysis may significantly understate the environmental impact of transportation in the food system.

The traffic-emission pollutants considered in this study included: hydrocarbons (gaseous), carbon monoxide, oxides of nitrogen (gaseous), carbon dioxide, particulate matter (PM2.5 and PM10)[52], and air toxins.[53] Estimates of the pollutants are presented in Table 19.

The underlying analysis indicates that highways 401, 403 and QEW are prominent in moving agricultural produce and products in Southern Ontario and are associated with high emissions for all the pollutants.[54]

FIGURE 19 → Estimated Annual Emissions Transporting Commodities to Markets (2011)

POLLUTANT	CEREALS	FRUITS & VEGETABLES	LIVESTOCK	TOTAL
	TONNES			
HYDROCARBONS	457	65	25	547
DISTRIBUTION	84%	12%	5%	100%
CARBON MONOXIDE	11,476	1,230	564	13,270
DISTRIBUTION	86%	9%	4%	100%
NITROUS OXIDES	6,395	456	260	7,111
DISTRIBUTION	90%	6%	4%	100%
CARBON DIOXIDE	753,759	49,405	28,739	831,903
DISTRIBUTION	91%	6%	3%	100%
SULFATES IN EXHAUST	3.23	0.21	0.12	3.6
DISTRIBUTION	91%	6%	3%	100%
PM 10	375.10	26.45	16.34	417.9
DISTRIBUTION	90%	6%	4%	100%
PM 2.5	329.78	23.32	14.43	367.5
DISTRIBUTION	90%	6%	4%	100%
BENZENE	8.52	1.13	0.43	10.1
DISTRIBUTION	84%	11%	4%	100%
BUTADIENE	3.38	0.42	0.18	4.0
DISTRIBUTION	85%	10%	5%	100%
FORMALDEHYDE	24.86	2.64	1.00	28.5
DISTRIBUTION	87%	9%	4%	100%
ACETALDEHYDE	7.53	0.76	0.30	8.6
DISTRIBUTION	88%	9%	3%	100%
ACROLEIN	1.84	0.21	0.07	2.1
DISTRIBUTION	87%	10%	3%	100%



Highways 401, 403 and QEW are prominent in moving agricultural produce and products in Southern Ontario and are associated with high emissions for all the pollutants.

In terms of a regional breakdown, Southwestern Ontario's emissions are about double those in the rest of Ontario.

This level reflects the relatively heavier agricultural production in the southwest and the movement of product to the more heavily populated areas to the east.[55] Distance traveled varies by commodity — for example, the average trip length is 262 km for wheat, 243 km for beef, and 84.6 km for grapes — and affects emission levels.

A breakdown by commodity indicates that the movement of cereals generates over 83% of all transportation emissions. Cereals account for 91% of carbon dioxide emissions, 87% of emitted carbon monoxide, and 90% of PM10 values. This is mainly due to the high tonnage of cereal, mostly grain corn and wheat, transported between Ontario counties and locations outside the province (imports and exports).[56] Among cereals, over 81% and in some cases, such as SO4 and PM10, over 90% of pollutants are generated from the movement of grain corn.[57] The southwest produces more grain cereal than do regions to the east. Due to the movement of a large quantity of cereal outside Southwestern Ontario — including to the United States — emissions within this region are considerably higher.

Transportation involving the fruit and vegetables group accounts for 12% of the hydrocarbon emissions, 9% of the carbon monoxide, 6% of the carbon dioxide, and 6% of PM10 values. Within this group, movement of potatoes is most prominent (with over 60% of emissions) followed by tomatoes (over 20%).

Transportation of livestock and poultry accounts for 5% of emitted hydrocarbons, 3% of carbon dioxide, and 4% of PM10 values. The movement of chicken has the most impact, followed by eggs and beef.

The pollution levels attributed to transportation are a subset of the overall environmental impact due to agricultural production and food manufacturing. As an example, the carbon monoxide linked with transportation requirements for the commodities discussed above — at 13,000 tonnes — accounts for 53% of the estimated carbon monoxide from activity tied to agriculture, as reported in Table 16. For carbon dioxide, transportation emissions of 832,000 tonnes represent only 6% of CO_2 associated with farming; and for particulates, the share is 8%. Transportation is but one component of the overall food system that contributes to its environmental impact.

A breakdown by commodity indicates that the movement of cereals generates over 83% of all transportation emissions.

SECTION 6

Food System Scenarios and Resulting Impacts

The baseline analysis of food surpluses and deficits by region across Southern Ontario (Section 3) suggests that there are significant opportunities for local supply chains to supply more local food requirements. Even after considering seasonality of harvest, climatic factors, and perishability (shelf life and storability) issues, it is clear that Ontario is importing substantial quantities of food that could be produced in the province. Some evidence also indicates that Ontario is importing and exporting many of the same food commodities even during the province's growing and storage seasons.

The study developed five specific scenarios based on potential shifts in farmer behaviour/practices, economic policy or consumer preferences, that range from import substitution to a healthier consumer diet to more production and consumption of organic foods. The scenarios offer a perspective on how changes to the Ontario food system could potentially affect Ontario's economy and environment.

SCENARIO 1 — IMPORT SUBSTITUTION OF TOP 10 FRUIT AND VEGETABLE IMPORTS

This scenario examines the implications of reducing imports by 10% and expanding domestic production for the top 10 vegetable and fruit imports.

Economic Impact of 10% Reduction in Top 10 Vegetable Imports

A 10% reduction in imports of the top 10 imported vegetables[58] does not necessarily call for additional local production to make up the difference. In some cases, such as tomatoes, peppers, carrots and sweet corn, it may involve diverting some exports to offset the import reduction. In others — for example, cabbage, lettuce and green beans — increased production may be needed. These different situations have somewhat different economic and environmental impacts.

A 10% reduction in the top 10 vegetable imports would mean a reduction of 75,500 tonnes or over $97.1 million in value. On a per capita basis, the replacement of imports with local production would involve very small substitutions with the largest at less than 1 kg per person per year of consumption (e.g., for tomatoes and lettuce). In the case of tomatoes, the import reduction would be approximately 12% of fresh tomato consumption and 3% of all fresh and processed forms of tomato consumption. However, since Southern Ontario has a tomato surplus of 24.9 kg per person, some product that is exported could be redirected to domestic consumption. Similarly, in the case of carrots, Southern Ontario has surplus production of 2 kg per person, and the 10% reduction in imports (at 0.44 kg per person) would represent a 4% drop in consumption, which could be more than offset by using more Ontario produced carrots for local consumption.

It is clear that Ontario is importing substantial quantities of food that could be produced in the province.

New local production would translate into $112.5 million in GDP throughout Ontario, the addition of 1,590 FTE jobs and $32.8 million in extra taxes to all levels of government.

In the case of cabbage, the 10% reduction would mean a 0.65 kg per person decrease in consumption. Ontario consumes more cabbage than it produces. With increased storage[59] and more acres growing this crop, the province has the potential to supply most cabbage requirements through local production.

Replacing these imports with local production is feasible based on a combination of redirecting some exports to the local market, expanding the acreage in production, and increasing and possibly lengthening storage well beyond the harvest period. This import replacement would redirect $97.1 million of imports into the local economies of Ontario, making a significant impact. New local production would translate into $112.5 million in GDP throughout Ontario,[60] the addition of 1,590 FTE jobs and $32.8 million in extra taxes to all levels of government (based on the multipliers in Table 11). Although these economic effects are province-wide, in the short term they are likely to be strongest in the counties that already show significant production capacity in these commodities.

Economic Impact of 10% Reduction in Top 10 Fruit Imports

A 10% reduction in imports of the top 10 imported fruits would involve a decrease of 70,100 tonnes worth about $126.6 million.[61] For most of these commodities, the resulting per capita reductions in consumption would be small (less than 10%) and could be replaced by local production.

Import replacement for fresh tender fruits (e.g., peaches) would be difficult since Ontario produces most of its own requirements during the growing season. On the other hand, imports of storable fruit crops, such as apples (import value of $106 million) and cranberries (import value of $98 million), are potentially replaceable. A drop in imports would not necessarily lead to additional local production; however, expanded Ontario fruit production could substitute for other imported commodities (e.g., Ontario apples and pears could replace imported bananas and oranges to some degree). As well, processing of some fruit as storable products, such as frozen strawberries, raspberries, and peaches may be able to substitute to an extent for fresh imported product.

Excluding bananas from the calculation, a 10% import substitution would expand Ontario's fruit production by $112.2 million to replace the value of imports. The Ontario-wide impacts would be $130 million in GDP, an additional 1,837 FTE jobs and an extra $37.8 million in total taxes. Again, the short-term economic effects are likely to be felt most strongly in areas that are already producing these commodities.

Environmental Impact of Lower Imports and Expanded Production

Substitutes for imports by increasing local production would reduce overall transportation requirements, as one aspect of the environmental

impact of agriculture. With fewer imports, transportation-related emissions for these commodities would be 59% lower, before accounting for the impact of more local production.[62] Transporting imports to local markets would produce substantially higher emissions than shipping the same volume of local product to local markets.

A 10% reduction in imports of eight fruit and vegetable crops would result in an estimated 59% reduction in CO_2 emissions (12,249 tonnes) from transportation of these commodities.

SCENARIO 2 — LOWER CONSUMPTION OF TOP 10 FRUITS AND VEGETABLE IMPORTS

A second scenario encompasses the lower imports associated with scenario 1; however, it does not lead to replacement of imports with local production. Rather, consumption is reduced by the same amount as imports. No significant economic impacts occur as there is no meaningful change in local production volumes. The major impact of lower consumption would be on the environment.

Environmental Impact of Reduced Consumption Due to 10% Lower Imports

In the scenario involving a 10% reduction in the top imports of fruits and vegetables, and a corresponding drop in consumption, emissions would generally decrease from their current levels. Using CO_2 as an example, the 10% reduction in imports of eight fruit and vegetable crops would result in an overall 59% reduction in emissions (12,249 tonnes) from transportation of these commodities. The largest emission savings would come from apples (10,250 tonnes of CO_2 — an 88% reduction) and tomatoes (2,885 tonnes of CO_2 — a 55% reduction). However, for grapes and dry onions, total emissions would increase somewhat. The reduced consumption per capita would lead to a larger surplus (with grapes) or changes a deficit position to a very small surplus position (dry onions). The expanded surplus would lead to higher export volumes (and resulting greater transportation requirements).

SCENARIO 3 — SHIFTING IMPORTS AND EXPORTS OF TOMATOES AND PEPPERS

Tomatoes and peppers are two of the top three imported vegetables. Ontario cannot be expected to reduce imports of these commodities in the months of January and February, as greenhouse production generally is suspended due to low light levels and high energy costs. In these two months in 2011, imports of tomatoes totalled 31,200 tonnes for a value of $60.4 million, while pepper imports came to 20,300 tonnes and a value of $42 million.[63] As well, Ontario has no appreciable exports of these two products during these two months.

Annual imports of peppers total 70,900 tonnes. After accounting for January and February imports, this leaves 50,600 tonnes of imported peppers that could be replaced by reducing Ontario's exports of this

Moving to the optimal diet would have a profound impact on per capita consumption, ranging from a slight decrease in consumption of tomatoes (by 1%) to an increase of 720% for green and wax beans.

product (which, in 2011, accounted for 61,600 tonnes). As well, Ontario has the potential to replace 95,200 tonnes of imported tomatoes[64] by curtailing a similar amount of tomato exports (105,600 tonnes in 2011).

Diverting exports to local consumption of tomatoes and peppers would have no effect on production levels, but would create a better match between local production and consumer requirements. Ontario would still have to import $60.4 million worth of tomatoes and $42 million worth of peppers if there were no domestic production. Under this scenario, suppliers of peppers and tomatoes would face only limited income reductions, as imports and exports are of almost equal dollar value per kg.

Environmental Impact of Lowered Tomato and Pepper Imports

The environmental impacts of this scenario are based on near self-sufficiency for Ontario in tomatoes and peppers and moving product from areas with a surplus to areas with a deficit. Overall transportation requirements would be lower since there would be no imports in the March to December period. Transportation-related emissions related to these commodities would be 54% lower, with CO_2 emissions 3,071 tonnes lower, compared to current levels.

SCENARIO 4 — CONSUMERS ADOPTING HEALTHIER DIET

Many Ontarians are not eating a diet that is optimal for health as recommended by Canada's Food Guide. In a recent study, Desjardins et al. (2010)[65] used these guidelines to quantify under-consumption of certain foods — particularly certain fruit, vegetables, dry beans and grains — and then identified opportunities for local producers to supply the new demand that would come from optimal dietary changes. This study followed the general approach employed by Desjardins to assess the impact on the food surplus/deficit position both within Southern Ontario and across all Ontario. Moving to the optimal diet would have a profound impact on per capita consumption, ranging from a slight decrease in consumption of tomatoes (by 1%) to an increase of 45% for apples, 105% for sweet corn and 720% for green and wax beans, as shown in Table 20.[66]

In the case of tomatoes, with current per capita consumption at 31.4 kg per person, the slightly lower level under the optimal diet would generate 1% more surplus in Southern Ontario. These extra tomatoes could easily be exported along with existing tomato exports.

However, with several commodities, a shift to a healthier diet would create new local food deficits or increase existing ones. To make up this shortfall, the province could either expand the acreage devoted to crops in the optimal food basket, increase imports, or both. One option would be to divert some of the land base now in cereals to the higher-value products in a healthier diet. Expansion of production to meet increased dietary

TABLE 20 → Changes in Food Surplus/Deficit by Adopting Optimal Diet (2010)

		SOUTHERN ONTARIO			ALL ONTARIO		
	INCREASE IN CONSUMPTION OPTIMAL VS. CURRENT	CURRENT FOOD SURPLUS/ DEFICIT	FOOD SURPLUS/ DEFICIT USING OPTIMAL	PERCENTAGE CHANGE (OPTIMAL VS. CURRENT)	CURRENT FOOD SURPLUS/ DEFICIT	FOOD SURPLUS/ DEFICIT USING OPTIMAL	PERCENTAGE CHANGE (OPTIMAL VS. CURRENT)
	%	1,000 TONNES		%	1,000 TONNES		%
TOMATOES	-1%	321	323	1%	298.6	300.9	1%
SWEET CORN	105%	41	-56	-235%	36.3	-66.6	-283%
OATS	386%	29	-70	-337%	44.9	-60.3	-234%
CARROTS	249%	24	-309	-1392%	16.2	-337.3	-2188%
WHITE BEANS	102%	9	-41	-558%	6.3	-46.3	-833%
BEANS	720%	-2	-170	8176%	-3.4	-181.1	5212%
CABBAGE	230%	-22	-171	685%	-25.3	-183.3	623%
STRAWBERRIES	69%	-49	-87	78%	-51.8	-92.0	78%
APPLES	45%	-104	-233	124%	-120.8	-257.2	113%
POTATOES	67%	-412	-873	112%	-445.5	-934.7	110%

requirements could have a widespread positive economic impact if the per-acre value of the newly expanded crop were greater than that of the crop being replaced.

Sweet corn offers an example of a food surplus changing to a deficit under an optimal diet. For this commodity, Southern Ontario would move from a surplus position of 41,000 tonnes to a deficit of 56,000 tonnes, given current production volumes. This represents a 235% decrease[67] in the food surplus position. This requirement could be supplied by an additional 11,000 hectares, which would essentially be a doubling of current sweet corn acreage. This change would be driven by the 105% increase in sweet corn consumption for moving to an optimal diet. More imports would be needed if local production did not expand enough to meet the demand.

Carrots, oats and white beans are three other cases where an optimal diet would move Southern Ontario from a food surplus to a food deficit situation.

Taking carrots as an example, the 249% increase in per capita consumption would shift Southern Ontario from a 24,000 tonne surplus to a 309,300 tonne deficit. This gap could be supplied by Southern Ontario farmers growing another 8,000 hectares of carrots. The additional volume could be stored under controlled temperature and atmospheric conditions, and carrots gathered in the fall could serve as the local supply source until the next harvest. However, since only approximately 4,000 hectares are currently in carrot production, a significant shift in cropping patterns would be required. To the extent this does not happen, Ontario will have to rely on imported carrots to meet the optimal dietary requirements.

Table 21 shows the impact of an optimal diet on regional carrot balances in Southern Ontario. The Greater Golden Horseshoe is currently almost self-sufficient in carrots, with a shortage of just 0.4 kg per capita. The 249% increase in carrot consumption under the optimal diet would increase the local carrot deficit significantly, from 3,900 tonnes to 243,000 tonnes. Southwestern Ontario, which is currently in surplus by 34,700 tonnes, would shift to a deficit position of 9,600 tonnes.

For commodities such as green beans, cabbage, strawberries, apples, and potatoes that are already in a deficit position, the optimal food diet would increase the shortfall. In the case of green and wax beans, the 720% increase in annual consumption would result in moving from a deficit of 2,000 tonnes to a deficit of 170,000 tonnes — a dramatic 8,176% increase.[68] Supplying this requirement from within Ontario would be equivalent to another 42,500 hectares in production, when currently there are slightly less than 4,000 hectares in green and wax beans. The additional demand could be met by a combination of sources, including more local production, more processed bean products (e.g., frozen beans) and increased imports of fresh beans during the winter season.

Southern Ontario currently has a deficit in apples, and the optimal diet would require a 45% increase in apple consumption. This would increase the deficit position from 104,000 tonnes to 233,000 tonnes — a 124% upswing.

TABLE 21 → Changes in Carrot Surplus/Deficit by Region by Adopting Optimal Diet (2010)

	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
MARKETED PRODUCTION	1,000 TONNES	43.9	48.1	92.0	52.5	0.8	157.6
PRODUCTION PER PERSON	KG/CAPITA	6.3	28.5	10.6	32.6	0.5	13.0
CURRENT FOOD SURPLUS/DEFICIT	KG/CAPITA	-4.8	17.5	-0.4	21.6	-10.6	2.0
CURRENT FOOD SURPLUS/DEFICIT	1,000 TONNES	-33.4	29.5	-3.9	34.7	-19.2	23.9
TOTAL OPTIMAL CONSUMPTION	1,000 TONNES	269.9	65.1	335.0	62.0	69.9	467.0
FOOD SURPLUS/DEFICIT USING OPTIMAL	1,000 TONNES	-226.0	-16.9	-243.0	-9.6	-69.1	-309.3
PERCENTAGE CHANGE (OPTIMAL VS. CURRENT)	%	577%	-157%	6162%	-128%	260%	-1392%

Table 22 indicates the regional impact of an optimal diet on apple balances in Southern Ontario. Within the Greater Golden Horseshoe, the current apple production deficit of 16.4 kg per person would increase from 142,600 tonnes to 234,800 tonnes — a 65% increase. In contrast, where Southwestern Ontario currently has a surplus of 70,200 tonnes, the optimal diets would reduce the surplus by 24% to 53,100 tonnes.

Southern Ontario currently has a deficit in apples, and the optimal diet would require a 45% increase in apple consumption.

TABLE 22 → Changes in Apple Surplus/Deficit by Region by Adopting Optimal Diet (2010)

	UNITS	GOLDEN HORSESHOE	OUTER GREATER GOLDEN HORSESHOE	GREATER GOLDEN HORSESHOE	SOUTH WESTERN ONTARIO	EASTERN ONTARIO	ALL SOUTHERN ONTARIO
MARKETED PRODUCTION	1,000 TONNES	32.5	29.2	61.7	108.0	10.6	180.7
PRODUCTION PER PERSON	KG/CAPITA	4.6	17.3	7.1	67.1	5.9	14.9
CURRENT FOOD SURPLUS/DEFICIT	KG/CAPITA	-18.9	-6.2	-16.4	43.6	-17.6	-8.6
CURRENT FOOD SURPLUS/DEFICIT	1,000 TONNES	-132.1	-10.5	-142.6	70.2	-32.0	-104.1
TOTAL OPTIMAL CONSUMPTION	1,000 TONNES	239.0	57.6	296.6	54.9	61.9	413.4
FOOD SURPLUS/DEFICIT USING OPTIMAL	1,000 TONNES	-206.4	-28.4	-234.8	53.1	-51.3	-232.7
PERCENTAGE CHANGE (OPTIMAL VS. CURRENT)	%	56%	171%	65%	-24%	60%	124%

Like carrots, apples are an example of storable crop, where controlled-atmosphere storage can be used to supply market requirements of some varieties for most of the year. The optimal diet scenario would require another 8,000 to 9,000 hectares in apple production, beyond the current land base of 6,400 hectares in Southern Ontario. Increased imports would be necessary to close any production gap.

Moving to Optimal Diet for Oats — Economic Impact

The optimal diet points to more consumption of some grains. Expanding local production to meet increased local requirements is an option that could create economic benefits.

Taking oats as an example, the optimal diet suggests consumption of another 70,000 tonnes of oats in Southern Ontario. Factoring in the surplus in Northern Ontario, this means that Ontario would need to offset a deficit of 60,300 tonnes.

A sustainable increase in local production would require expanding production on new lands or substituting production on existing land. To meet the deficit, a 126% increase would be needed in land planted with oats in Southern Ontario, which is another 25,000 hectares. Since Northern Ontario has oats production that is surplus to human food requirements, an 80% increase would be required (23,000 hectares) across Ontario as a whole.

In general, production increases are not expected to occur in the counties where there is a consumption deficit. It is more likely that the extra output would come primarily from areas already in oats production. The most likely counties to supply large increases in oats include: Renfrew, Nipissing, Simcoe, Grey, Bruce, Wellington, and Kawartha Lakes.

Meeting the optimal consumption level would require a total of 132,000 tonnes of oats produced for human consumption. Current production of oats across Ontario is approximately 72,000 tonnes for all uses, so this requirement would translate into an additional production of about 60,000 tonnes. Oats for human consumption have reached prices of over $250/tonne, indicating that $15.2 million of additional revenue would accrue from the new production. The economic impacts[69] would include the following:

- Increase of $14.2 million in Ontario's GDP;
- Increase in wages and salaries of $7.7 million;
- 241 more FTE jobs; and,
- Additional tax revenues of $3.8 million to the three levels of government, with $1.3 million going to the province and $383,000 to local governments.

The optimal diet scenario involves reductions in foods that are currently overconsumed from the point of view of optimal health, particularly some grain-based food products and some animal products.

Moving to Optimal Diet without Increasing Local Production — Transportation Emissions

If we assume that all additional requirements to meet production deficits are met through imports, then an optimal diet leading to higher consumption of fruits, vegetables, small grains and beans would lead to higher transportation emissions. For the products used in this analysis, these emissions would increase by 190%, for which CO_2 would represent an increase of 92,665 tonnes. The largest impact would be in carrots (a 1,988% increase in emissions and a CO_2 impact of 36,457 additional tonnes), followed by potatoes (28,847 tonnes of CO_2, and 110% larger emissions), apples (13,215 more CO_2 tonnes and 113% higher emissions) and green beans (11,920 additional tonnes of CO_2 and a 5,212% increase in emissions). All of these products have large supply imbalances based on an optimal food diet. Increasing local production along the lines discussed earlier in this section would reduce these transportation-related environmental impacts.

The above discussion has considered the potential production and land use impacts of transitioning from a conventional food consumption basket to an optimal food basket. However, given that we can eat only so much, the optimal diet scenario also involves reductions in foods that are currently over-consumed from the point of view of optimal health, particularly some grain-based food products and some animal products.[70] An assessment of the net impact on Ontario production requirements and implied land use calls for a much more comprehensive assessment than provided above. The reductions in consumption, primarily of animal products, would somewhat depress economic activity in those sectors, but also reduce greenhouse gas (GHG) emissions.[71] However, supply management in dairy, eggs, chicken and turkey provides an orderly mechanism for any demand reduction. As reported above, Ontario is already in a deficit situation with beef, so reduced consumption would not necessarily mean reduced production and could mean reduced imports. Pork, however, is in surplus, so there would be production decreases in this sector unless exports

Organic food has the potential for significant growth driven in part by the substantial environmental and economic benefits it promises.

are significantly increased. An optimal diet scenario could also result in increases in sheep and goat production, which could somewhat offset declines in the other animal sectors. In summary, reduced consumption of animal products may not have much impact on local production but could have a larger impact on imports and exports.

SCENARIO 5 — TRANSITION TO ORGANIC FOOD

This scenario analyzes a shift to organic production in Ontario and the resulting implications on food balances, land requirements and the environment. Organic food has the potential for significant growth driven in part by the substantial environmental and economic benefits it promises. Organic production reduces chemical fertilizer and pesticide applications as well as growth-promoting antibiotics and medications used in animal feed.[72, 73, 74] It has also been established that organic methods lead to reduced pollution and increased biodiversity with substantially lower energy demands and GHG emissions. [75, 76]

Table 23 summarizes the impact on food surpluses/deficits for a number of farm products,[77] assuming that all production is organic. This analysis is based on the work of MacRae et. al. (2009)[78] and applies Ontario land use and production data to show the impact of an admittedly unrealistic 100% transition to organic production from the current level of 1-2% of farmed acres.[79] Although some might believe a full transition of all conventional food to organic is desirable, it is more reasonable to assume that only 10% is achievable in the first 15 years of such an effort. This report first discusses the challenges associated with full transition (Table 23) and then considers the more feasible 10% conversion option.

Differences in food surplus/deficit balances are based on the yields resulting from organic versus conventional production. The changes in yields range from no impact with oats to 5% lower for wheat, 20% lower for most vegetable crops and 25% lower for fruit crops.[80]

In the case of grains, Ontario has a surplus with conventional production and remains in a surplus position with organic production. This surplus of production over consumption reflects the use of a large portion of grain as livestock feed or for such purposes as ethanol. In a short period of time, all grain-based food products could be supplied from organic sources in Southern Ontario.

For most fruit crops, a movement to organic production would increase the food deficit. In the case of apples, the deficit position would grow by 43% in Southern Ontario to 149,000 tonnes from the current 103,900 tonnes. Without an increase in the production base, Ontario would need to import more organic fruit products.

TABLE 23 → Changes in Food Surplus/Deficit by Transitioning to 100% Organic Production (2010)

		SOUTHERN ONTARIO			ALL ONTARIO		
	UNITS	TOTAL ORGANIC FOOD SURPLUS/ DEFICIT	TOTAL CONVEN-TIONAL FOOD SURPLUS/ DEFICIT	CHANGE — ORGANIC VS. CONVENTIONAL FOOD SURPLUS/ DEFICIT	TOTAL ORGANIC FOOD SURPLUS/ DEFICIT	TOTAL CONVENTION-AL FOOD SURPLUS/ DEFICIT	CHANGE — ORGANIC VS. CONVENTIONAL FOOD SURPLUS/ DEFICIT
WHEAT	1,000 TONNES	679.9	754.2	-10%	652.4	727.5	-10%
OATS	1,000 TONNES	29.4	29.4	0%	44.9	44.9	0%
BARLEY	1,000 TONNES	174.9	184.2	-5%	197.0	207.4	-5%
CORN	1,000 TONNES	3,785.7	4,207.8	-10%	3,787.8	4,210.2	-10%
GRAPES	1,000 TONNES	-12.6	2.2	-670%	-15.9	-1.1	1323%
PEACHES	1,000 TONNES	-9.4	-3.9	144%	-11.0	-5.4	102%
STRAWBERRIES	1,000 TONNES	-50.2	-48.7	3%	-53.3	-51.7	3%
APPLES	1,000 TONNES	-149.0	-103.9	43%	-165.8	-120.6	37%
TOMATOES	1,000 TONNES	165.0	301.0	-45%	158.0	298.0	-47%
SWEET CORN	1,000 TONNES	14.5	41.2	-65%	9.4	36.2	-74%
PEPPERS	1,000 TONNES	14.0	29.9	-53%	13.8	30.4	-55%
CARROTS	1,000 TONNES	-7.6	23.9	-132%	-15.4	16.1	-196%
BEANS	1,000 TONNES	-4.2	-2.1	102%	-5.6	-3.4	62%
ONIONS	1,000 TONNES	-26.5	-7.6	248%	-32.6	-13.7	138%
CABBAGE	1,000 TONNES	-30.3	-21.7	40%	-34.0	-25.3	34%
POTATOES	1,000 TONNES	-467.2	-411.0	14%	-502.5	-444.7	13%
PORK	1,000 TONNES	-199.4	129.2	-254%	-215.6	113.5	-290%
TURKEY	1,000 TONNES	-0.7	13.3	-106%	-4.2	9.9	-142%
LAMB	1,000 TONNES	-2.9	-2.9	0%	-3.3	-3.3	0%
CHICKEN	1,000 TONNES	-120.2	-50.9	136%	-144.0	-74.5	93%
BEEF	1,000 TONNES	-276.6	-134.3	106%	-288.8	-147.3	96%
EGGS	DOZEN	-24,205,062	45,919,807	-153%	-35,320,647	35,085,682	-201%

In vegetable crops, tomatoes, sweet corn and peppers would remain in a surplus position, though a smaller one (e.g., 45% less for tomatoes in Southern Ontario). Carrots, based on a 20% yield reduction, would move from a surplus position (23,900 tonnes) to a deficit position (7,600 tonnes), assuming per capita consumption remained constant and acreage did not increase. The deficit in onions would grow by 18,900 tonnes and all other vegetable crops would also show an increased deficit position. Again, more acreage or more imports would be required to close the gap.

In animal agriculture, where Southern Ontario is surplus in pork, turkey and eggs, moving to 100% organic farming would result in the need to import these products to meet consumer demand, unless production increases. In the case of eggs, the province would moves from a surplus of 35.1 million dozen to a shortage of 35.3 million dozen.

Overall, unless Ontario's acreage base increases to match consumption, moving to a 100% organic diet would result in lower agricultural production in the province, due to lower yields, and potentially a greater reliance on imported food. Although there would be substantial environmental benefits from a shift to organic production, these would be somewhat moderated by increased emissions linked with increased imports.[81]

10% Transition to Organic Production

As mentioned, it is more reasonable to assume that a 10% transition to organic food consumption is achievable over a 15-year period. At this level, for example, Southern Ontario would not have a deficit position in carrots, but rather a 20,700 tonne surplus (a 13% reduction compared to conventional production). For apples, the production deficit would increase by 13% from the level with conventional production (to 117,400 tonnes).[82]

For many foods, achieving a 10% transition to organic production represents opportunities that are realistic and not overly disruptive to supply chains. As well, from an overall food system perspective, the above analysis has not assessed the impact on farm income, which would reflect lower yields, price premium estimates (e.g., the price premium for organic wheat compared to hard red spring wheat is approximately 44%), and potentially higher per farm earnings despite the lower yields.[83] Higher per farm earnings would result in a larger province-wide economic contribution. Additionally, the study has not assessed the dietary shifts that occur as households shift to organic foods, which typically bring consumption more in line with the optimal diet scenario discussed above.[84]

For most fruit crops, a movement to organic production would increase the food deficit.

SECTION 7

Overview of Findings

Ontario's food system is huge, generating more than $63 billion in sales of food products to consumers and employing more than 767,000 people — 11% of the paid labour force. The core of the food system is the agriculture sector that generates $11.5 billion in farm products. Farmers depend on an array of businesses that supply them with resources to grow crops and produce livestock and poultry, including equipment, feed, seed and energy. The system also includes food processing and manufacturing, food distribution, food retailing and food service operations.

IMPORTS NEEDED TO MEET CONSUMER REQUIREMENTS

One characteristic of the food system is that Ontarians consume more food than the province produces, resulting in food imports that approach $20 billion per year. Over 50% of the $20 billion in imported food products can be produced in Ontario. This presents an opportunity for the Ontario food system to produce substantially more food within the province.

Seizing this opportunity will generate more Ontario-wide economic activity, including more jobs and an increase in GDP. As well, with fewer imports, transportation requirements to ship in food from the out-of-province supply sources decrease, reducing the environmental impact of the food system.

FOOD BALANCES VARY BY REGION

The Ontario-produced food that residents consume often does not come from the locality where they live. Instead, certain regions of the province specialize in certain types of agriculture. Some of this specialization is due to natural conditions, such as soil and climate. For example, most peach production occurs in the Niagara area.

This report divides Southern Ontario into four distinct regions to highlight current food imbalances (a surplus or deficit in local production compared to consumption). These regions are: the Golden Horseshoe with 15% of farm output, the Outer Greater Golden Horseshoe (21% of farm output), Southwestern Ontario (52% of farm output) and Eastern Ontario (12% of farm output).

Each region has surplus food production in some commodities as well as food deficits that are met by shipping food in from other regions or by imports. The Golden Horseshoe with over $1.7 billion worth of farm products, generates more grapes, peaches and soybean oil than consumers in the region require, but has a deficit in all other food products due to the large population in the GTA. The Outer Greater Golden Horseshoe with at least $2.4 billion worth of farm products is in a deficit position for most fruits and vegetables — with carrots, onions, sweet corn and potatoes the exceptions. This region is also in a surplus position in grain products and all livestock products.

OVERVIEW OF ONTARIO FOOD SYSTEM

$63 billion
sales generated

767,000
people employed

Agriculture
generating
$11.5 billion
in farm products

50%
of currently imported food could be produced locally

COMBINED ENVIRONMENTAL IMPACTS FROM FARM-RELATED ACTIVITIES, FOOD PROCESSING & MANUFACTURING IN ONTARIO

511,000

terajoules of energy used

50,600

tonnes of carbon monoxide &

29 million

tonnes of carbon dioxide released into the atmosphere

Southwestern Ontario generates more than $6.1 billion in farm product — the most in the province. It produces significantly more apples than residents consume, and has surplus production for most vegetables, all grain products, and all livestock and poultry products. Within the Ontario food system, the southwest region is the Golden Horseshoe's primary supply source for many food products.

Eastern Ontario accounts for around $1.4 billion in farm products but has a shortfall of most foods. The region has a deficit relative to local requirements for wheat products and all fruits and vegetables and, in animal agriculture, has a surplus in eggs and lamb, but a deficit in beef, pork, and poultry products.

STRONG PROVINCE-WIDE ECONOMIC IMPACT

The economic contribution of agriculture is significant, with the spin-off effects due to farm sector expenditures generating $29.3 billion in gross output (overall economic activity) province-wide. This in turn creates 214,000 FTE jobs throughout Ontario and sustains provincial GDP of $15.1 billion. Governments benefit from this economic activity through $4.4 billion in tax revenues. These economic impacts are generally proportional to agricultural production, so that just over half of these impacts are due to agriculture in the southwest region.

The food processing and manufacturing sector makes a stronger economic impact than agriculture alone. The contribution of food manufacturing to overall Ontario-wide employment is 273,500 FTE jobs, with direct food processing jobs just under 88,000. The gross output created, which includes the purchases of farm products as inputs to food manufacturing, is almost $54 billion — leading to $21.3 billion in province-wide GDP.

However, the processing sector is more concentrated than agriculture. Based on employment data, 61% of food manufacturing occurs in the Golden Horseshoe and 78% in the Greater Golden Horseshoe. The southwest region with 52% of farm production accounts for only 15% of food processing employment, so agricultural production is much larger than the next stage in the value chain. The most employment, gross output and GDP impact from processing is attributable to the Golden Horseshoe because of the industry's concentration there.

WIDESPREAD ENVIRONMENTAL IMPACTS

Ontario's food system also leaves a large environmental footprint. The impacts from all farm-related activities — direct, indirect and induced — include a net usage of 99 million cubic metres of municipal water, an estimated 25,800 tonnes of carbon monoxide emissions, 14.2 million tonnes of carbon dioxide, energy usage of 262,000 terajoules, 509,000 tonnes of waste and 3,900 tonnes of contaminates. The use of resources and

environmental impacts are distributed through the regions in rough proportions to their farm production.

Looking at food processing and manufacturing, the economic activities driven by this sector likewise have a substantial impact on the environment. The use of resources is close to that of farming-related activities, with 115 million cubic metres of net municipal water consumption, and 249,000 terajoules of energy. Other impacts include 24,800 tonnes of carbon monoxide, 14.8 million tonnes of carbon dioxide, 1.4 million tonnes of waste and 6,900 tonnes of contaminants. Economic activity associated with food manufacturing generates somewhat less CO, somewhat more CO_2 and significantly more waste and contaminants than does agricultural production.

In the food system, farm products are transported from surplus to deficit areas. The above impacts include those from transportation requirements reflecting linkages within the Ontario economy. A large share of transportation emissions occurs as a result of shipping surplus grain products out of the southwest region. In fact, an estimated 91% of CO_2 emissions arise from the movement of grain. Six to 12 percent of transport emissions are due to movement of fruits and vegetable products.

COMBINED ENVIRONMENTAL IMPACTS FROM FARM-RELATED ACTIVITIES, FOOD PROCESSING & MANUFACTURING IN ONTARIO

214 million

cubic metres of municipal water used

1.9 million

tonnes of waste generated

10,800

tonnes of contaminates released

IMPLICATIONS OF STRUCTURAL CHANGES IN FOOD SYSTEM

This report examines five specific scenarios that illustrate how changes to farmer behavior and practices, consumer preferences and economic policy can have significant economic and environmental consequences.

One scenario examines the **expansion of Ontario production to replace 10% of the top 10 fruit and vegetable imports.** In the case of most vegetables, replacing the top 10 imports with local production is feasible based on a combination of redirecting some exports into the local market and increasing the acreage and storage of vegetables that can be kept well beyond the harvest period. Direct import replacement for many fruits is not realistic since Ontario produces most of its own requirements while the crop is in season. However, direct import replacement is feasible for storable fruit crops such as apples (with an import value of $106 million). Expanded Ontario production of apples and pears can also substitute to some degree for other imported fruits that Ontario cannot produce (e.g., bananas and oranges) and for fresh fruits with a limited shelf life. As well, processing some tender fruits as storable products — such as frozen strawberries — may be able to supplant fresh imported product to some extent.

Increased local production to offset the 10% reduction in imports of fruits and vegetables could result in an additional $242.5 million in provincial GDP and an associated 3,400 FTE jobs. Although such economic effects are province-wide, in the short term they are likely to be strongest in the counties that already show significant production capacity. As well, with

fewer imports, transportation requirements to ship food from the out-of-province supply sources also decrease, reducing the environmental impact of the food system.

A second scenario involves **matching a 10% reduction in the top 10 fruit and vegetable imports with a corresponding reduction in consumption.** Since local production volumes would remain the same, there would be no significant economic impacts. However, the environmental consequences of reducing imports and consumption by the same amount would be significant, as the emissions from transporting imports to local markets are substantial. Transportation emissions due to these commodities would decrease, with CO_2 production, for example, falling by 59% (or 12,200 tonnes). The largest savings would be due to shipping fewer apples, field and greenhouse tomatoes, and carrots.

A third scenario assesses the impact of **shifting imports and exports of comparable products**, taking peppers and tomatoes as an example. With limited local greenhouse production of tomatoes and peppers in January and February, this scenario eliminated imports for the remaining 10 months of the year and diverted surplus local production to satisfy Ontario's requirements. This shift was found to have a minimal effect on production levels, but would create greater correspondence between local production and consumption. Income changes in the pepper and tomato supply chains would be limited, as imports and exports are of almost equal dollar value per kilogram. However, the change in environmental impact according to this scenario would be considerable. Transportation-related emissions for these commodities would drop by an estimated 54% as both imports and exports decrease.

REPLACING TOP FRUIT & VEGETABLE IMPORTS WITH ONTARIO GROWN PRODUCE

$250 million

GDP (Gross Domestic Product) increase

3,400

New, full-time-equivalent jobs

A fourth scenario is based on the fact that many Ontarians are not eating a diet that is optimal for health when considering Canada's Food Guide. **A move to an optimal diet** would make a marked difference in per capita consumption — ranging from a slight decrease in consumption of tomatoes (by 1%) to an increase of 45% for apples, 105% for sweet corn, 249% for carrots, and 720% for green and wax beans. These changes in consumer choice would affect provincial and regional food balances dramatically.

Taking carrots as an example, the optimal diet would move Southern Ontario from a surplus of a 24,000 tonnes to a deficit of 309,300 tonnes. This deficit could be supplied by Ontario farmers based on growing another 8,000 hectares of carrots; however, currently only around 4,000 hectares are in carrot production. A major shift in cropping patterns or a reliance on imported carrots or both would therefore be necessary to meet the optimal requirements. The Greater Golden Horseshoe is currently almost self-sufficient in carrots, with a shortage of just 0.4 kg per capita. The 249% increase in carrot consumption due to the optimal diet would increase the regional carrot deficit sharply from 3,900 tonnes to 243,000 tonnes. Southwestern Ontario, which is currently in surplus by 34,700 tonnes, would shift to a deficit position of 9,600 tonnes.

SHIFTING TO AN OPTIMAL DIET

Higher consumption & demand of fruits and vegetables

Local food production responds & increases

Some of local production is stored and/or processed

Provincial GDP increases and jobs are created

For apples, Southern Ontario is currently in a deficit position, and the optimal diet calls for a 45% increase in apple consumption. This translates into an increase in the apples deficit from 104,000 tonnes to 233,000 tonnes, a 124% upswing. Within the Greater Golden Horseshoe, the current apple production deficit of 16.4 kg/person or 142,600 tonnes would increase to 234,800 tonnes. In contrast, Southwestern Ontario currently has a surplus of 70,200 tonnes, which the optimal diet would reduce by 24% to 53,100 tonnes. Self-sufficiency in apples would require another 8,000 to 9,000 hectares in apple production, over and above the Southern Ontario's current production base of 6,400 hectares. If this does not happen, more imports will be needed. Apples and carrots are storable crops. Increased local production can be stored in a controlled atmosphere to supply market requirements for most of the year until the next harvest.

Expansion of production to meet these altered dietary requirements could have a widespread positive economic impact when the per-acre value of the newly expanded crop is greater than that of the farm product being replaced. One option is to divert some of the land base now in cereals to the higher-value products in a healthier diet. In such cases, the positive impact would accrue not only to farmers, but to the food system and to the overall Ontario economy.

As suggested above, an optimal diet would lead to higher imports of fruits and vegetables unless Ontario production expands in tandem with local demand. More imports would result in higher transportation emissions. For the products considered in this analysis, emissions would increase by 190%, which for CO_2 would increase by 93,000 tonnes. The largest impact would be in carrots (a 1988% increase), followed by potatoes (up 110%), apples (113% higher) and green beans (a 5212% increase). All of these products would have large imbalances based on an optimal food diet. This impact analysis is based on the assumption that all additional requirements would be met through imports; increases in local production would reduce these transportation-related environmental impacts.

The optimal diet scenario also involves reductions in foods that are currently over-consumed from a health point of view, particularly some grain-based food products and some animal products. Reduced consumption of animal products is not expected to have a significant impact on local production but could have a larger impact on imports and exports.

A fifth scenario offers a perspective on **shifting to organic food production** and the resulting implications for food balances, land requirements and the environment in Ontario. Food surpluses and deficits are estimated based on presumed impacts on yields from a shift to organic production over a transition period. While these calculations were based on a transition to 100% organic production, it was recognized that a more realistic scenario would be a transition to 10% organic.

In the case of grains, Ontario has a production surplus with conventional methods and remains in a surplus position with organic production. In a

short period of time, all grain-based food products could be supplied from organic sources in Southern Ontario.

For most fruit crops, a movement to organic production would increase the current supply shortage. In the case of apples, the current supply deficit would increase by 43% in Southern Ontario to 149,000 tonnes from 103,900 tonnes. Without an increase in the production base, Ontario would need to import more organic fruit products.

In the vegetable crop sector, tomatoes, sweet corn and peppers would remain in a surplus position, though a smaller one (e.g., 45% less for tomatoes in Southern Ontario). Carrots, based on a 20% yield reduction, would move from a surplus position (23,900 tonnes) to a deficit position (7,600 tonnes), assuming per capita consumption remained constant and acreage did not increase. The deficit in onions would grow by 18,900 tonnes and all other vegetable crops also show an increased deficit position. More acreage or more organic imports would be required to close the gap.

In animal agriculture, where Southern Ontario has a surplus of pork, turkey and eggs, moving to 100% organic farming would result in the need to import these products to meet consumer demand, unless production increases. In the case of eggs, the province would move from a surplus of 35.1 million dozen to a shortage of 35.3 million dozen.

For many foods, achieving a 10% transition to organic production represents opportunities that are realistic and not overly disruptive to supply chains. Although we did not assess the impact on farm income, the literature suggests potentially higher per farm earnings despite lower yields. Higher per farm earnings would result in a larger province-wide economic contribution. Additionally, the study has not assessed the dietary shifts that occur as households shift to organic foods, but the literature suggests such shifts would bring consumption more in line with the optimal diet scenario discussed above, providing further potential benefits.

EFFECTS OF TRANSITIONING TO ORGANIC PRODUCTION
(without increasing local organic production)

Grains, tomatoes, sweet corn and peppers remain in surplus

Fruits and other vegetables remain in deficit

Carrots, pork, turkey and eggs move from surplus to deficit

Notes, Credits & Acknowledgments

NOTES

This report summarizes more extensive research contained in the *Economic and Environmental Background Reports* referred to below. These reports can be accessed at: www.greenbelt.ca/research

1. We have opted to use GDP instead of value added to represent net income or net output impacts. The former is more familiar to most readers, yet value added removes any possible confusion with gross output which double counts impacts.

2. This region includes the City of Toronto and the City of Hamilton and the Regions of Niagara, Halton, Peel, York, and Durham. There is high overlap between this geography and the Greenbelt.

3. These include Waterloo Region and the Counties of Haldimand, Brant, Wellington, Dufferin, Simcoe, Peterborough, and Northumberland, and the Municipality of Kawartha Lakes.

4. These include the Municipality of Chatham-Kent and the Counties of Norfolk, Essex, Lambton, Elgin, Middlesex, Oxford, Perth, Huron, Grey, and Bruce.

5. This region is to the east and north of the Greater Golden Horseshoe and includes the following: the City of Ottawa and the Counties of Stormont, Prescott, Leeds Grenville, Lanark, Frontenac, Lennox, Renfrew, Prince Edward, Haliburton, Parry Sound, and Hastings and the District Municipality of Muskoka,

6. The Census valuation is based on 2010 values.

7. Northern Ontario accounts for 1.5% of Ontario's farm production.

8. It can also be noted that the top eight agricultural counties in Southern Ontario (the first eight in the above listing) had sales that exceeded the sales in any of the Atlantic Provinces in 2012.

9. More detail for each County and Region can be found in the Economic Background Report.

10. This statistic excludes inter-provincial shipments of food products, see also Figure 1.

11. Processing of some locally grown perishable fruits and vegetables can substitute for imported product in the post-harvest season.

12. Poultry, egg and dairy are supply managed and import volumes are governed by the trade agreements.

13. Bendavid-Val, A. 1991. *Regional and Local Economic Analysis for Practitioners, 4th edition.* Praeger, New York.

14. Agri-food exports also include exportation of imported agri-food products, including exports of tropical products that undergo value added activities in Ontario.

15. Bendavid-Val, *Op. Cit.*

16. Census data was used for County level population and for production of crops (reported for 2010, and livestock inventory. County level livestock inventory was used to distribute known Ontario production for red meats.

17. Consumption estimates use local population and national per capita consumption values.

18. The Economic Background Report has tables that provide data on surplus deficit position by county and region for a number of commodities.

19. Field grown cucumbers and greenhouse cucumbers are not included in the analysis.

20. A subsequent analysis could investigate the degree to which surpluses/deficits relate to the production of oats specifically for human consumption.

21. It can be noted that a county such as Huron may have a large surplus in beef cattle production; however, the cattle are typically shipped to another county such as Wellington or into the GTA for processing into beef products. These products are then shipped back to the beef cattle surplus county.

22. Employment figures in this section include both full and part-time jobs.

23. See Tables 1–3 in the Economic Background Report. The 2013 values are from the same data series and are also available on OMAFRA's website.

24. Source: Statistics Canada, 2011 National Household Survey, Statistics Canada Catalogue no. 99-012-X2011052. This data is based on residency of the employee and was used by Statistics Canada to estimate employment by region in 2013.

25. This represents 4.7% of paid employment in the associated 11 counties and regions.

26. If using all of Ontario as a reference point, the Golden Horseshoe accounts for 60% of food manufacturing employment.

27. In the Economic Report this is referred to as Gross Provincial Product.

28. This GDP data is also available on the OMAFRA website and is provided in Table 1 of the associated Economic Report.

29. For 2013 in inflation adjusted dollars (using 2007 as the base).

30. The model utilizes a large set of economic and technical databases for Canada that are regularly published by Statistics Canada. (Statistics Canada: Inter-provincial Input Output Tables, Catalogue № 15F0042XDB). A short list includes the inter-provincial input output tables, employment by sector, taxes by type of tax and the level of government collecting it, prices of products, energy used in physical and energy units, etc. The input output structure of Ontario has changed significantly over the years. Major trends have changed and significant restructuring has been observed. Several manufacturing industries have disappeared or reduced considerably their operations and employment complements. Recognizing the importance and significance of these changes, Statistics Canada generates input output tables for each year, albeit with a four or five years lag. As a result, the economic multipliers and measured economic impact of a certain expenditure level can change over time.

31. Initial Expenditure and Direct Gross Output are not the same in Table 11 as would normally be the case. The difference is due to the calibration of Initial Expenditures that was required to generate a direct agriculture GDP that is consistent with what Statistics Canada had estimated for Ontario in 2011. For the same reason, the Initial Expenditure figure in Table 11 does not match the $11.5 billion value for crop and livestock/poultry production in Figure 1.

32. It is common in the literature to find definitions of multiplier that divide total impacts by direct impacts. The definition used here is significantly different from the conventional one; the conventional definition exaggerates the ripple effects as will be demonstrated later. Our preference for dividing total impact by initial impact is predicated on the fact that what drive the impacts are the initial expenditures and not the direct impacts; the latter are a consequence of the initial expenditures.

33. This employment is sustained by a high volume of expenditures on labour, utilities, transportation and other inputs that exceeded $13.7 billion in Southern Ontario.

34. For reference purposes, the Economic Background Report provides the economic impact data for each county is the four regions used in Tables 12 to 14.

35. Based on the labour force survey, just over 757,200 employees lived in these 11 counties.

36. The employment multiplier is relatively low compared to other industrial employment multipliers in Ontario.

37. The economic impact results due to farm operational expenditures are presented for each of the counties and regions in the Economic Background Report.

38. The effective wages and salaries sustained by these expenditures are reasonable and are consistent with general manufacturing wages in Ontario. The direct effective wage is over $37,198 and the total effective wage is higher at $41,467. Effective indirect and induced wages are significantly higher than those in agriculture.

39. The effective wages and salaries sustained by these expenditures are comparable to wages in other sectors in Ontario. The direct effective wage is over $38,185 and the total effective wage is higher at $42,367.

40. Effective wages are the payments to labour per FTE job.

41. The main driver of environmental impact is the activities underlying the gross output values (i.e., see Tables 2 and 3).

42. The input-output analysis used here to quantify the environmental impacts generates these impacts simultaneously with the determination of the output and GDP effects. More detail can be found in the Environmental Background Report. The environmental data is based on data collected and supplied by various parties including those supplied by Industrial Economics (INDECO), Decision Support Systems (DSS), Victor, Hanna and Burel (VHB) the Ontario Ministry of the Environment (some of which has been updated).

43. Green GDP is the value that results from subtracting from the current GDP the expenditures made on planting trees that absorb the full CO_2 generated in the economy.

44. The analysis did not account for the CO_2 capture by crops and the release of O_2.

45. The water intake does not include rainfall, an essential input into crop production.

46. Households and the Environment: Energy Use, 2007, Statistics Canada, Catalogue no. 11-526-S

47. More detail on the environmental impact by county is available in the supporting Environmental Background Report.

48. Mostly backward linkages to upstream suppliers.

49. These environmental impacts use a different methodology than that for the system wide environmental impacts, and the transportation effects should be viewed as a component of the overall impact measured in Tables 7 to 9.

50. These food balances were summarized in Section 3 of this report.

51. The analysis is based on using a specific origin-destination model and subsequent transportation network, truck flows and truck sizes. The premise underlying these determined product flows is that shipment of a commodity between an origin county and a destination is proportional to the production of the origin and the consumption of the destination and inversely proportional to some function of the distance between the origin and the destination. More detail is provided in the Environmental Background Report. Using truck flows on the transport network, emissions of pollutants were derived using the software package Mobile 6.2c, a version of the MOBILE6 Vehicle Emission Modeling Software, developed by the U.S. Environmental Protection Agency and customized for the Canadian fleet of vehicles (see for example, The Canadian Transit Company (2007), *CEAA Environmental Impact Assessment, Ambassador Bridge Enhancement Project*, pp 21). The results of the analysis provide, for each commodity, the number of weekday trips by commodity and the resulting impact on environmental emissions due to transportation. This analysis does not consider transformation (processing) of products in one region and then shipped to another region for final consumption, or shipments out of a region to processing and then returning back to a region for consumption based on processing capacity not existing in the region (e.g., as in the case of most livestock products). As a result, the values reported in Table 10 can be much less than is realized by current practices.

52. PM2.5 and PM10 include the following: SO_4 — sulfate portion of exhaust particulate, OCARBON — organic carbon portion of diesel exhaust particulate, ECARBON — elemental carbon portion of diesel exhaust particulate, GASPM — total carbon portion of gasoline exhaust particulate, Lead — Lead Portion of Exhaust Particulate, SO_2 — Sulphur Dioxide (gaseous), NH_3 — Ammonia (gaseous), Brake - Brake Wear Particulate, and Tire — Tire Wear Particulate.

53. The air toxins included Benzene, 1,3-Butadiene, Formaldehyde, Acetaldehyde, and Acrolein.

54. The values in Table 10 are metric, which compare to the values in the supporting report which were in short tons.

55. Tonnage allocated to heavier truck types (e.g., combination semitrailer, combination double/triple) as opposed to the lighter ones (e.g., single unit) increases with trip distance. For example, a combination semitrailer is allocated 13% of the tonnage for travel distance of 80 km-160 km, and is allocated 75% of the tonnage for a distance of 320 km to 800 km. Vehicle emissions increase with increase in truck payload.

56. Soybeans were not included in this analysis, which has a production volume that is more than wheat, with shipments to Hamilton, Windsor the major traffic routes.

57. The associated report provided details on an individual commodity basis, such as grain corn shipments generated 628,679 tonnes of CO_2.

58. In descending order of value these are; tomatoes, lettuce, peppers, other fresh vegetables, cabbages, carrots and turnips, onions and shallots, head lettuce, vegetable mixtures, and cauliflowers and broccoli. These account for 69% of all vegetable imports.

59. Cabbage can be stored into May, as noted by OMAFRA.

60. These values exclude exports that are redirected to supply local needs.

61. The top 10 fruit imports account for 61% of all imports, which include (in descending order of value) grapes, strawberries, raspberries, blackberries, bananas, cherries, apples, cranberries and bilberries, oranges, and mandarins.

62. The smaller environmental impact in this scenario is somewhat less than is shown for the following scenario.

63. Monthly import values are provided in the Economic Background Report.

64. This is total imports of 126.4 thousand tonnes minus January and February imports of 32.1 thousand tonnes.

65. Desjardins et al. 2010.

66. These changes in per capita consumption use the Desjardin optimal annual per capita consumption that do not account for food waste, with these values adjusted by food specific food waste factors (as reported in Desjardins) to arrive at a comparable per capita consumption value as reported by Statistics Canada for each of these foods. The food waste factor for beans is 1.75 and for 1.64 for apples, as an example.

67. When negative percentages are shown they mean that either the food surplus has been reduced, or there has been a shift from a food surplus to a food deficit.

68. When positive percentages are displayed for products already in a deficit position, the value simply means that the food deficit has increased.

69. This economic impact analysis assumes that all oats is used for food purposes; rather in reality a portion of Ontario oats production is used for animal feed. Supplying all optimal food requirements from local production as well as continuing to use some oats for livestock feed would result in more additional oats production and greater economic impact.

70. These impacts were not modeled.

71. MacRae, R. Cuddeford, V. Young, S.B. Matsubuchi-Shaw, M. (2013). The Food System and Climate Change: An Exploration of Emerging Strategies to Reduce GHG Emissions in Canada, Agroecology and Sustainable Food Systems 37(8):933-963

72. Willer, H. and Yussefi, M. 2006. The World of Organic Agriculture 2006 — Statistics and Emerging Trends, 8th revised edition. IFOAM, Bonn, Germany.

73. MacRae, R., Martin, R.C., Macey, A., Doherty, P., Gibson, J., and Beauchemin, R. 2004. Does the Adoption of Organic Food and Farming Systems Solve Multiple Policy Problems? A Review of the Existing Literature. Organic Agriculture Centre of Canada, Truro, NS.

74. MacRae, R., Frick, B., and Martin, R.C. 2007. Economic and social impacts of organic production systems. Canadian Journal of Plant Science 87(5):1037-1044.

75. MacRae, R.J., Lynch, D. and Martin, R.C. 2014a. Will more organic food and farming solve multiple food system problems? Part I: Environment. In: R.C. Martin and R. MacRae (eds.). *Managing Energy, Nutrients and Pests in Organic Farming Systems.* CRC Press, Boca Raton, FL, p. 307-332; MacRae, R.J., Lynch, D. and Martin, R.C. 2014b. Will more organic food and farming solve multiple food system problems? Part II: Consumer, Economic and Community Issues. In: R.C. Martin and Rod MacRae (eds.). Managing Energy, Nutrients and Pests in Organic Farming Systems. CRC Press, Boca Raton, F., p. 333–362.

76. An analysis of the specific implications for Ontario would add to the current knowledge base and help improve decision making with respect to organic food production and food systems.

77. Note that the set of products analyzed by MacRae et al. (2009) was not entirely consistent with our baseline economic analysis for this study, so we adjusted accordingly.

78. MacRae, R.J., R.C. Martin, J. Langer, and M. Juhasz. 2009. Ten percent organic within 15 years: Policy and programme initiatives to advance organic food and farming in Ontario, Canada. *Renewable Agriculture and Food Systems* 24(2):120-136

79. The analysis does not identify the number of years it takes to accomplish this transition and any of the associated costs. At the farm level, transitioning to organic food is costly; particularly over the first three years of the transition as production losses are high. Additionally, MacRae et. al. (2009) estimated that this program would contribute significantly to reducing the externalized costs of current approaches to agriculture, conservatively estimated at $145 million annually or $2.18 billion over the 15-year life of the program. We did not account for these costs nor did we assume that all these costs would be saved within the 15-year transition period.

80. *Ibidem*

81. Note, however, that production is the greatest source of GHG emissions, substantially larger than end user transport (MacRae, R. Cuddeford, V. Young, S.B. Matsubuchi-Shaw, M. (2013). The Food System and Climate Change: An Exploration of Emerging Strategies to Reduce GHG Emissions in Canada, Agroecology and Sustainable Food Systems 37(8):933-963).

82. This illustration is not based on a simple 10% of the values in Table 23.

83. An organic scenario could add additional economic value on the farm and throughout the economy.

84. MacRae, R.J., Lynch, D. and Martin, R.C. 2014b. Will more organic food and farming solve multiple food system problems? Part II: Consumer, Economic and Community Issues. In: R.C. Martin and Rod MacRae (eds.). *Managing Energy, Nutrients and Pests in Organic Farming Systems.* CRC Press, Boca Raton, F., p. 333–362

PHOTOGRAPHY

COVER	Dan Barnes (iStock.com/dan_prat), 2011
PG. 4	Friends of the Greenbelt Foundation, 2014
PG. 6	Zvonko1959 (iStock.com/zvonko1959), 2014
PG. 12	Friends of the Greenbelt Foundation, 2012
PG. 16	Friends of the Greenbelt Foundation, 2012
PG. 23	Friends of the Greenbelt Foundation, 2012
PG. 26	Friends of the Greenbelt Foundation, 2012
PG. 31	Friends of the Greenbelt Foundation, 2012
PG. 35	Friends of the Greenbelt Foundation, 2012
PG. 38	Friends of the Greenbelt Foundation, 2014
PG. 47	Easy Asa (iStock.com/easyasa), 2014
PG. 52	Friends of the Greenbelt Foundation, 2013
PG. 59	Imagixian (iStock.com/imagixian), 2012
PG. 61	Jeffrey Heyden-Kaye (iStock.com/heydenkaye), 2009
PG. 62	Friends of the Greenbelt Foundation, 2012
PG. 69	Friends of the Greenbelt Foundation, 2010
PG. 75	Friends of the Greenbelt Foundation, 2013
PG. 76	Dan Barnes (iStock.com/dan_prat), 2011
PG. 81	Mediagram (iStock.com/dutchscenery), 2014
PG. 84	Friends of the Greenbelt Foundation, 2012

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