

Economic Impacts of Connecticut's Agricultural Industry *Update 2015*

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Department of Agricultural and Resource Economics
University of Connecticut



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Dedication

This report is dedicated to the memory of Bernie Dzielinski, wonderful alumnus and friend of Connecticut agriculture.

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Peter Gunther is Senior Research Fellow at the Connecticut Center for Economic Analysis, responsible for its Quarterly Outlook reports. He has extensive experience in Regional Economic Models, Inc. (REMI) applications in several areas, including Connecticut development initiatives, R&D tax credits to accelerate economic recovery, and adoption of plug-in vehicles fueled by green electricity.

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STUDY HIGHLIGHTS

Scope and Methodology

The purpose of this study is to ascertain and document the importance of agriculture and related industries to Connecticut's economy and to show changes over time in these industries between 2007 and 2015 by updating the previous economic impact study. Thus, we use the same sectors as in the 2010 study (Lopez et al., 2010) as a benchmark.

The agricultural industry is defined as encompassing crop and livestock production, forest products, and the processing of the state's agricultural production. The study excludes secondary sectors such as landscaping and grounds keeping; agricultural processing that does not use Connecticut agricultural inputs; and industries, such as bakeries and distilleries, that are economically important but which, if included, would overstate the projected output and job impacts attributable directly to the state's agriculture.

Because the agricultural industry purchases goods and services from other industries and hires local labor, its economic impact cascades throughout the state economy. **Agriculture support services include feed suppliers, veterinary services, equipment manufacturers and repair, and financial services.** Farm businesses also support short-term contractual jobs in engineering, construction, plumbing, electrical work, and inspection, among others.

In this report, we also provide rough measures of the value of some non-traditional benefits of the agricultural sector in Connecticut. These measures include the amount of carbon sequestered in farmlands and the economic value of this activity, the value of agritourism and direct-marketed sales to consumers in Connecticut, and the value that Connecticut residents place on agricultural land as open space.

Using direct sales of the agricultural industry for 2015, this study estimates the total economic impact of agriculture on the Connecticut economy through the use of three economic models. Two are input-output models that translate direct sales into statewide output and jobs to account for agriculture's purchase of goods and services from other industries. The third is a statistical model of the entire state economy that measures agriculture's importance by estimating the loss of output and jobs if the sector were removed from the state's economy.



a.

Photo by Kristie Schmitt at Casertano's Greenhouse and Farms, Cheshire, CT

Results of the Analysis

This analysis reveals that in 2015, depending on the model used, the **total impact of Connecticut's agricultural industry** on the state economy was between **\$3.3 and \$4.0 billion**, measuring the value of agricultural output as statewide sales generated directly from the industry and through spillover effects on other industries. To be sure, we measured a small contraction in real output since 2007, once sales were converted to real dollars, which we attribute to the changing structure of agriculture in the state in favor of specialty crops and value-added agriculture, with some decline in some traditional sectors such as tobacco farming and greenhouse, nursery, floriculture, and sod between 2007 and 2015.

- The estimated output impact translates into nearly **\$1,127 in sales per Connecticut resident**.
- **Every dollar** in sales in the agricultural industry **generates an additional two dollars** in the state economy.

In addition, the Connecticut agricultural industry **generates between 20,007 and 21,696 jobs statewide**, contributing from \$759 to \$899 million in wages.

- Every million dollars of the agricultural production sector's direct sales generate 7 to 32 jobs. Overall, the agricultural industry in the state generates more jobs per million dollars of sales than nearly any other sector in the rest of the state economy.
- Agricultural production is more labor intensive than agricultural processing, generating two-thirds of the industry's jobs.

In sum, the agricultural industry has a critical and significant impact on the economy of Connecticut in output, jobs, and quality of life: **up to \$4.0 billion in output, 21,696 jobs, and significant social and environmental benefits.**



ECONOMIC IMPACTS OF CONNECTICUT'S AGRICULTURAL INDUSTRY

UPDATE 2015

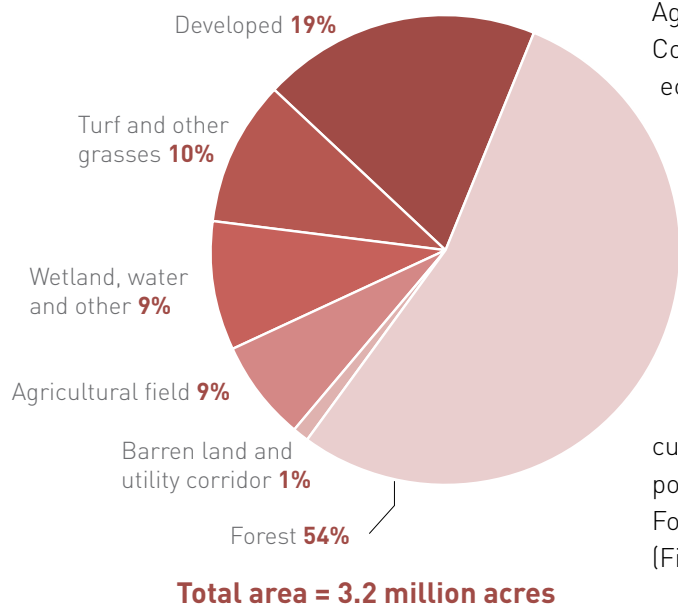
INTRODUCTION

The purpose of this study is to ascertain and document the significance of agriculture and related industries to Connecticut's economy and to show changes over time from 2007 to 2015. This study defines the Connecticut agricultural industry as encompassing crop and livestock production, forest products, and primary agricultural processing tied to the state's agricultural production. Because the agricultural industry buys goods and services from other industries in the state and hires local labor, its economic impacts cascade throughout the state economy.

Using three models of the Connecticut economy, this analysis estimates the 2015 statewide economic impacts of the Connecticut agricultural industry as follows: statewide sales are in the range of \$3.3 to \$4.0 billion, generating 20,007 to 21,696 jobs and approximately \$759 to \$899 million in wages. Additional impacts flow from ecological and social benefits from agricultural and forest production and related recreation, wildlife, and quality of life effects.

CONNECTICUT'S AGRICULTURAL INDUSTRY AT A GLANCE

Figure 1 Total Land Cover in Connecticut (2015)



Source: Center for Land Use Education and Research (2006)

Agriculture has been a critical component of the Connecticut economy since colonial times, when the state's economy was comprised of mainly agriculture, fishing, lumber, and ship building. Today the importance of agriculture in the state economy remains high not only through farms but also associated forests.

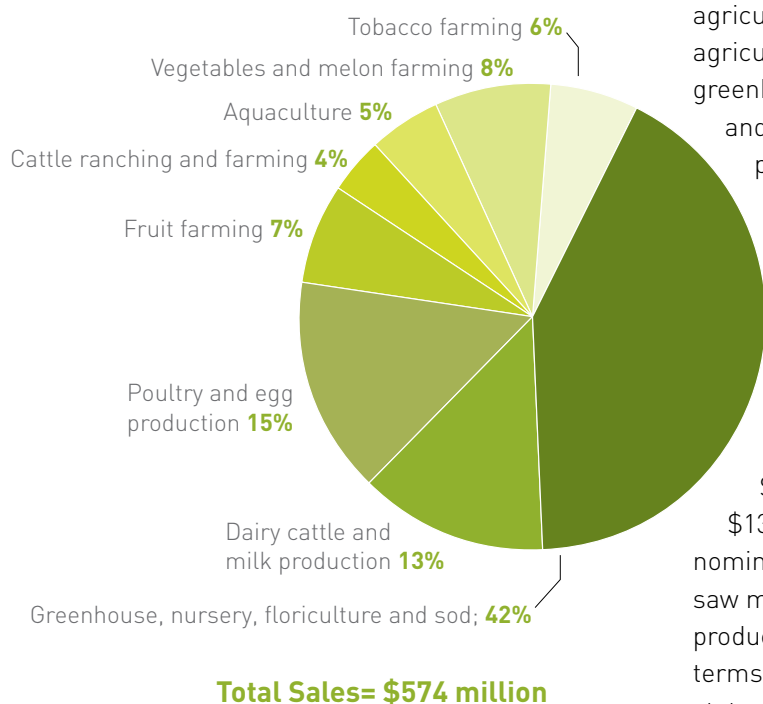
Connecticut's geographical area is approximately 3.2 million acres, making it the third smallest state in the United States (ahead of Delaware and Rhode Island). In spite of the state's small size, its agriculture continues to thrive, and the amount of farmland, currently at 440,000 acres (covered with agricultural fields, ponds, and forests), accounts for nearly 14% of total area. Forests covered more than half of the state in 2015 (Figure 1).

Moreover, despite its small size, Connecticut agriculture ranks third in New England in farm sales, which totaled \$574 million in 2015 (Figure 2). The state's agriculture is not only economically important but also quite diverse.

As illustrated in Figure 2, in sharp contrast to agriculture nationwide, field crops comprise a minor share of agricultural sales in Connecticut, while the largest agricultural sectors are "green" industries (nursery, greenhouse, floriculture, and sod production), vegetable and fruit farming, dairy cattle and milk production, and poultry and egg production. The greenhouse, nursery, floriculture, and sod sector is by far the largest farm sector in the state in terms of direct sales. Thanks to record egg prices in 2015, the poultry and egg production sector ranked second in agricultural production in the state, surpassing the milk and dairy production sector which incidentally faced plummeting prices.

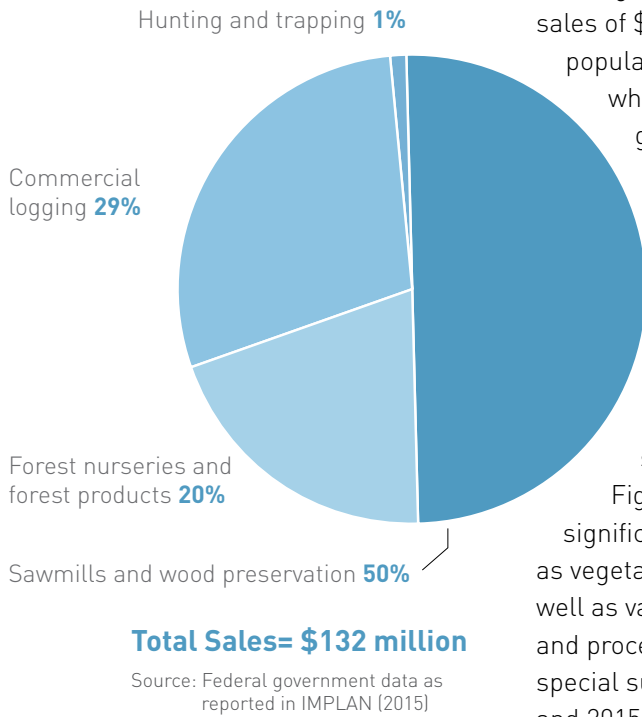
Sales of forest products accounted for approximately \$132 million in 2015 (Figure 3), up by \$1 million (in nominal dollars) from 2007. As illustrated in Figure 3, saw mill/wood preservation and forest nurseries/forest products are the largest in the forest products segment in terms of sales. By far, however, the main benefits accrue to state residents from open space and other environmental benefits provided by forests.

Figure 2 2015 Sales of Agricultural Products by Commodity Groups



Source: IMPLAN (2015), USDA NASS (2016), USDA (2013, 2015, 2016)

Figure 3 2015 Sales of Forest Products and Related Sectors



Dairy processing leads primary agricultural processing, accounting for more than half of total direct sales for the broad industry, followed by animal slaughtering and fruit and vegetable canning, with nearly identical shares (Figure 4). Wineries, with sales of \$85.8 million in 2015, are enjoying rapid growth and popularity in response to increased demand for local wines, which in turn has increased derived demand for local grapes. Sales for winery products are up from \$30 million in 2007.

What changed between 2007 and 2015? Considering aggregate direct sales in 2007 (Lopez et al., 2010), the farm sector expanded slightly from \$551 million in 2007 to \$574 million in 2015. Meanwhile, sales of forest products remained flat at around \$132 million, while sales of primary agricultural processing sectors expanded from \$995 million to \$1,224 million.

Figures 5 and 6 compare direct sales by subsectors. A significant expansion in sales occurred in specialty crops such as vegetable and fruit farming, poultry and egg production, as well as value-added industries like wineries, seafood preparation, and processed dairy products (excluding cheese). All of these special subsectors experienced significant growth between 2007 and 2015. On the other hand, sectors such as tobacco farming and greenhouse, nursery, floriculture, and sod production have contracted. The latter can be explained in part by the Great Recession after 2007 (the last year of a housing construction boom, with the housing bubble bursting in April 2008, at the outset of the financial crisis). It is also important to note that while commercial fishing experienced a steep decline in sales, due mainly to a decline in wild-caught fish, the seafood industry shift to aquaculture is consistent with regional and national trends.

Aquaculture has expanded significantly since 2007: by nearly 100% in nominal sales. Thus, the agricultural industry in Connecticut appears to be restructuring into new market segments where innovation, diversity, and economic viability are key. This may be a consequence of external factors such as competition from other regions and countries as well as natural shocks like climate change.

Figure 4 2015 Sales of Primary Agricultural Processing Sectors

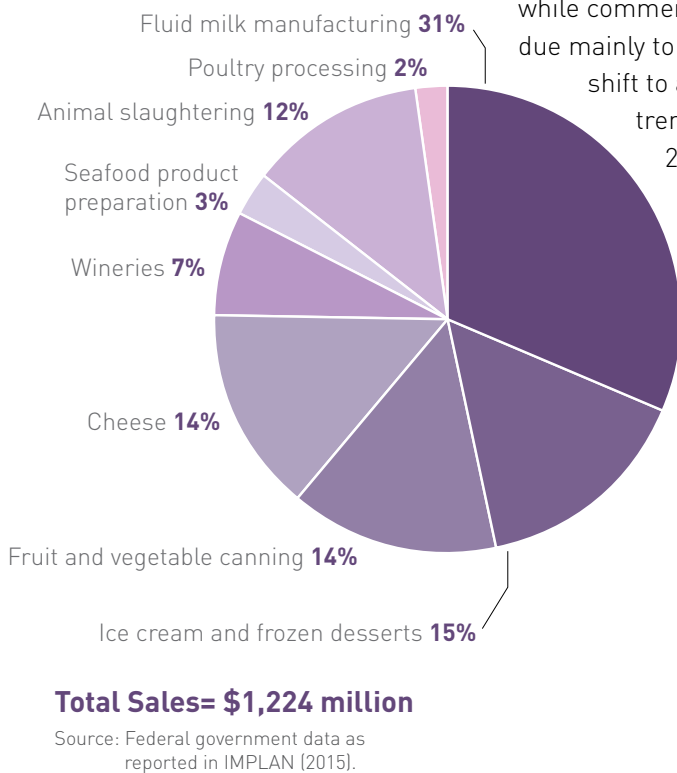
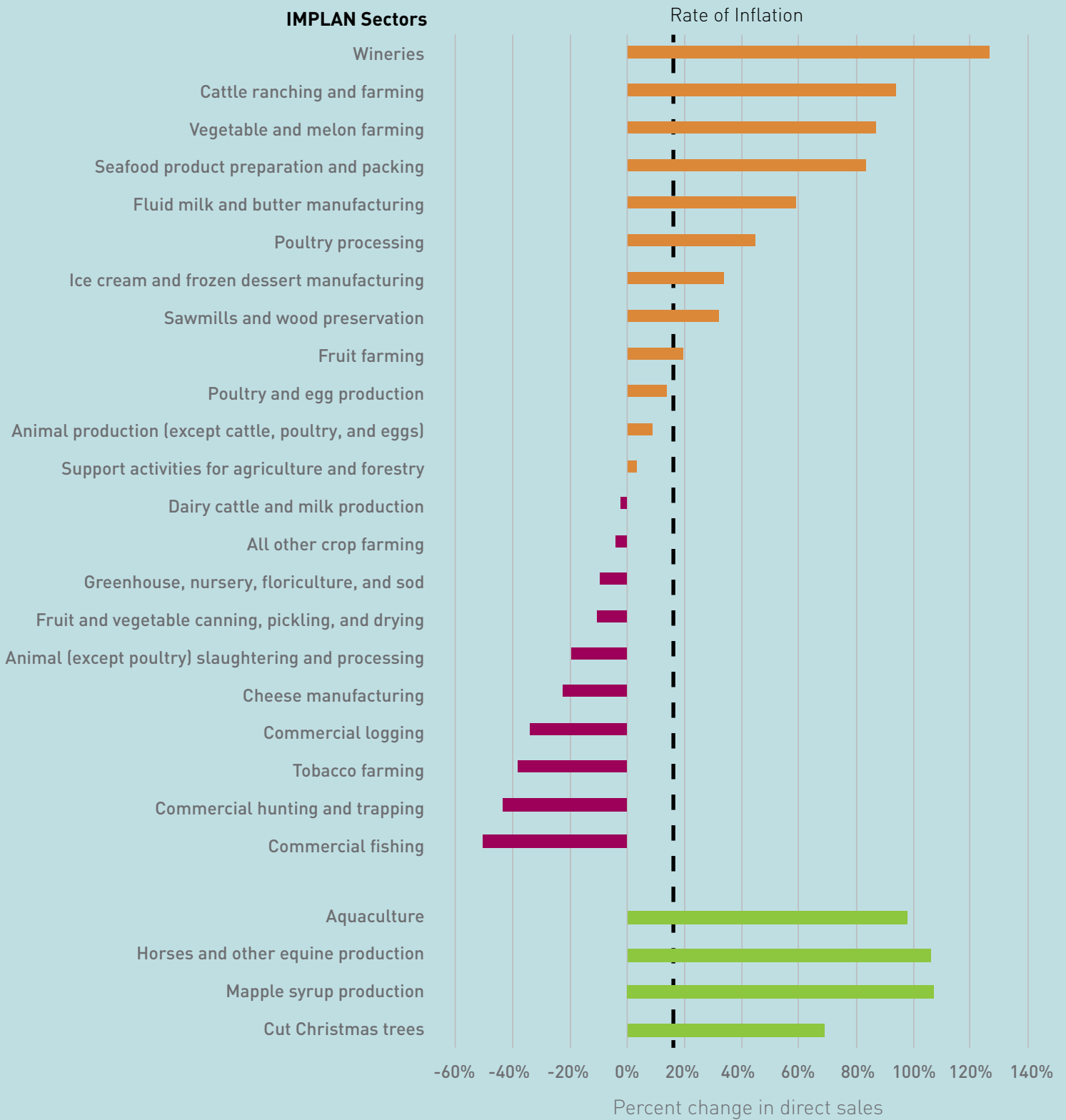


Figure 5

Percent Change in Direct Sales (Nominal Dollars) between 2007 and 2015 for IMPLAN Sectors and Special Subsectors



Source: Federal government data as reported in IMPLAN for the years 2007 and 2015, US Census of Aquaculture (2013), Ibarburu (2016), and USDA Poultry Production and Value Summary (2015, 2016)



METHODOLOGY

Economic Models Used

This study uses three standard models of the Connecticut economy to capture the scope of the agricultural industry and its linkages to the rest of the state economy, and to assess its contribution to statewide output and jobs. The three models are:

- IMPLAN (IMPLAN, 2015)
- RIMS II (Regional Input-Output Modeling System; U. S. Department of Commerce, 2015)
- REMI (Regional Economic Models, Inc., 2015)

IMPLAN and RIMS II look at incremental impacts as a sector increases or decreases in activity via built-in multipliers based on input-output tables of the economy. Both use multipliers that express the change in the level of state output and jobs associated with a unit change in direct sales in a specific sector or industry of the economy. An important feature of the IMPLAN and RIMS models is that they focus on “supply” to an industry, treating the sector of interest as the point of final “demand.” For example, using these models, the impact of the dairy cattle and milk production sector on the fluid milk manufacturing sector would be minimal (except through indirect and induced impacts as defined below), but the impact of the fluid milk manufacturing sector on the dairy cattle and milk production sector would be accounted for by milk suppliers within the state.

In addition to the above supply chain impacts, REMI is an econometric model of the state economy. REMI estimates economic impacts (including impacts on migration) by assessing the loss of output and employment when a sector is removed from the economy. Thus, rather than focusing on the impact on suppliers, it is concerned with overall statewide impacts. REMI treats employment impacts in a more flexible fashion, allowing for migration and

job relocation across sectors within the state. For example, a worker who loses his or her job in the greenhouse industry and ends up working at a grocery store, in landscaping, or at Home Depot will not be accounted for in the economy-wide job impacts as the model treats this as a transfer rather than a loss.

The models use direct sales from a sector of the agricultural industry as input to calculate economy-wide impacts through multipliers (RIMS, IMPLAN) or simulation (REMI), (see Table A1 of the Appendix).¹ Note that to the extent that some cash and bartering transactions and self-consumption are not reported, particularly by small farmers, the figure for direct sales of the agricultural production sector might under-represent the total value of production and therefore the corresponding impacts. Although all three models offer insights into the economic importance of a particular sector of the economy, they differ in some underlying assumptions and in the level of sophistication of the analysis. For completeness, this study reports the outcomes of analyses using all three models.

Sectors Included

Following standard practice, this study relies on the U.S. Department of Commerce (USDC) classification of sectors of the economy, and uses all sectors classified as agricultural and forestry production and primary agricultural processing to define the scope of Connecticut's agricultural industry. This process results in 27 sectors, described in Table A3 of the Appendix. Note that the IMPLAN and RIMS models are based precisely on the USDC classification. Thus, their multipliers (shown in Table A1 of the Appendix) were readily available. REMI collapses sectors, so we matched a subset of them closely to the 27 USDC descriptions. Examples include grain farming, greenhouse, nursery, and floriculture production, dairy cattle and milk production, cheese manufacturing, and wineries.

The decision to select sectors for inclusion in the scope of this study was based on the USDC classifications for agriculture, fishery, and forestry. For agricultural processing, we considered the extent of linkages to state farming. In sum, we used the same sectors included in the 2010 study to benchmark the current results and then vetted those sectors with stakeholders. Some economically important Connecticut food and beverage processing sectors are excluded from this study because they do not use agricultural commodities produced in the state in any significant way. Examples of such "secondary processing" sectors are chocolate, confectionary, and bakery product manufacturing and distilleries. Including secondary food and beverage processing that does not use state agricultural production would overstate the contribution of agriculture to the state economy.

¹ All direct sales numbers provided by IMPLAN (2015) were verified for accuracy. An issue that needed particular attention was that the direct sales reported by IMPLAN for 2015 Connecticut poultry and egg production (reported at \$56.1 million) was significantly below the estimates implied by other reports and asserted by the Connecticut Department of Agriculture. Note that, due to confidentiality, direct sales for this sector were not reported by USDA in 2015 and that nearly all the value of production in this sector is due to eggs rather than poultry meat production. Since our estimate has to be verifiable from official sources, we employed two methods that can be backed up by public data. First, we multiplied changes in the Northeast farm prices for eggs between 2014 and 2015 (Ibarburu, 2016) by 2014 egg production sales in Connecticut reported by USDA (2015), attaining an estimate of \$83.10 million. Second, we multiplied the ratio of the production of eggs in Connecticut to Maryland's in 2014 times egg production sales in Maryland in 2015 (USDA 2015, 2016), attaining an estimate of \$85.57 million after adjusting for a 1% unit price differential. Since the two methods yield similar numbers, we use the average number of the two at \$84.34 million (cf., \$56.1 million in IMPLAN). The number reported by IMPLAN is very close to the averages of 2013 and 2014 USDA numbers, thus not taking into account the record high prices for eggs in 2015.

Measures of Impacts

Using the above models, the study develops three indicators of the economic importance of the agricultural sector:

- *Total impact on state output*, whose value is measured by statewide sales
- *Total impact on state employment*, which includes full- and part-time jobs generated
- *Total impact on wages*, which measures impacts on labor income statewide

Although the primary focus is on the total impacts at the state level, this report also discusses the impacts at the individual subsector levels.

For example, the economic importance of the greenhouse, nursery, floriculture, and sod production industry (“greenhouse and nursery”) in Connecticut is not limited to the \$243 million worth of goods and services sold by that sector (the direct impact). That sector’s effect extends to other sectors of the economy (e.g., the transportation and utility sector) because greenhouse and nursery businesses buy goods and services from those other sectors (the indirect impact). Also, employees of greenhouse and nursery establishments likely spend a major portion of their earnings buying goods and services from other firms within the state (the induced impact). The total sales impact of the greenhouse and nursery industry is the sum of the direct, indirect, and induced impacts. The same reasoning applies to the employment and wages impacts of the industry. In the data appendix (Table A1), the RIMS and IMPLAN multipliers are applied to direct sales in the greenhouse and nursery subsector to obtain the impact on total state output, employment, and wages.

The REMI model uses direct sales to assess the impact on statewide output and employment when the agricultural sector is removed. Impacts from subsectors using REMI were not computed due to time and budget constraints, as this would require detailed analysis of each subsector. REMI is a general equilibrium model where the subsectors are intertwined. For comparison to RIMS and IMPLAN multipliers, the REMI multipliers are imputed based on the ratio of the agricultural industry’s statewide impacts to direct sales.

Finally, it should be noted that the estimated impacts are limited to Connecticut’s economy. For example, when an apple orchard in Connecticut purchases pesticides from a firm in Massachusetts, aside from minor local wholesale margins here, the indirect impact of this transaction will not be felt in the Connecticut economy.



Photo by Morty Ortega, Jr. at Freund's Farm, East Canaan, CT

Measures of Non-Traditional Impacts

We have included three measures of non-traditional impacts in this report. They include:

- Amount of carbon sequestered per year on Connecticut farmlands. According to the National Sustainable Agriculture Information Service (Schahzcenski and Hill, 2009) and the EPA Greenhouse Gas Inventory Report (EPA, 2014), agricultural soils in the U.S. typically sequester approximately 32 million metric tons of carbon dioxide equivalents per year per acre. We use this value to approximate the amount of carbon sequestered on the 440,000 acres of agricultural land in Connecticut. Then we multiply this amount by the social cost of carbon (EPA, 2017) to derive an estimate of the economic value of the carbon sequestered on agricultural land in the state.
- Economic impact of direct marketed sales to consumers and agritourism. In 2015 the USDA Census of Agriculture began conducting the Local Food Marketing Practices Survey to benchmark data about local food sales in the U.S. We use data collected in this survey to estimate the economic impact of local food systems and agritourism in Connecticut (USDA, 2015).
- Connecticut household willingness to pay for open space in agricultural land. We describe data from previously published reports on willingness to pay for agricultural open space in Connecticut.



RESULTS

Total Output Impacts

The total output impact (i.e., measured in dollar sales) of the agricultural industry that the three models estimate is between \$3.3 and \$4.0 billion in 2015, with an average of \$3.6 billion across the three models, in an economy of \$260 billion in Gross State Product in that year. On a per capita basis, the agricultural industry generates approximately \$1,127 in sales per Connecticut resident, based on a total impact of \$4 billion.

The impact of the agricultural and forest production sector on the state's economy is between \$1.33 and \$1.96 billion, or \$1.55 billion, on average. The models project the impact of the primary agricultural processing sector as between \$1.92 and \$2.01 billion, with an average of \$1.98 billion, with 61% coming from the dairy processing industry.

Table 1 presents more detailed IMPLAN and RIMS II estimates of statewide sales impacts from individual sectors of the agricultural industry (as noted above, REMI results are not available at the sector level). Table 1 shows the most sales statewide were generated by greenhouse, nursery, floriculture, and sod production; fruit and vegetable canning, pickling, and drying; cheese manufacturing; ice cream and frozen dessert manufacturing; meat processed from carcasses; poultry and egg production; wineries; and fluid milk manufacturing.

Table 1 – Statewide Impact on Sales

		2015 million dollars		
Sector		RIMS II	IMPLAN	REMI
Agricultural and forest production	Oilseed farming	0.5	0.6	-
	Grain farming	18.8	19.3	-
	Vegetable and melon farming	65.2	74.7	-
	Fruit farming	65.4	74.5	-
	Tree nut farming	4.9	5.5	-
	Greenhouse, nursery, floriculture, and sod	454.2	408.8	-
	Tobacco farming	56.5	61.5	-
	All other crop farming	53.0	59.6	-
	Cattle ranching and farming	30.0	35.2	-
	Dairy cattle and milk production	117.2	120.5	-
	Poultry and egg production	128.6	129.6	-
	Animal production (except cattle, poultry, and eggs)	62.6	75.6	-
	Commercial logging	58.3	62.7	-
	Sawmills	87.9	114.8	-
	Wood preservation	13.5	16.4	-
	Commercial fishing	24.6	22.6	-
	Commercial hunting and trapping	2.9	3.1	-
	Support activities for agriculture and forestry	85.2	78.6	-
		Total for agricultural and forest production	1,329.3	1,363.6
Primary agricultural processing	Fruit and vegetable canning, pickling, and drying	319.16	277.6	-
	Fluid milk and butter manufacturing	618.11	617.7	-
	Cheese manufacturing	280.42	274.9	-
	Ice cream and frozen dessert manufacturing	326.03	289.7	-
	Animal (except poultry) slaughtering and processing	41.55	50.8	-
	Meat processed from carcasses	155.94	167.0	-
	Poultry processing	35.04	33.4	-
	Seafood product preparation and packaging	64.61	64.6	-
	Wineries	154.15	145.0	-
	Total for primary agricultural processing	1,995.0	1,920.7	2,110.0
Total for the agricultural industry		3,324.3	3,284.3	4,046.4
Some special sub-sectors	Cut Christmas trees	10.3	11.6	-
	Maple syrup production	2.6	3.0	-
	Horses and other equine production	13.8	16.6	-
	Aquaculture	41.2	49.7	-
	Direct marketed sales to consumers	65.6	75.2	-
	Agritourism	18.1	16.2	-
	Honey	0.9	1.1	-

Sector by sector impacts were not estimated for the REMI methodology due to time and budget constraints, since this task would require a detailed analysis of each sector.



Total Employment Impacts

Table 2 shows the impact of the agricultural industry on state employment: a contribution of between 21,007 and 21,696 jobs. That is, the number of jobs estimated by all three models is within a 510 difference in the number of jobs created. Regardless of the model used, these estimates seem to be on the low side when compared to the direct jobs estimates provided by the 2007 Census of Agriculture and by the U.S. Census Bureau of Labor Statistics (Warner and Lopez, 2013). Thus, the jobs estimates we report should be considered conservative.

This study shows that Connecticut's agricultural industry is an important contributor to employment in the state. Agricultural and forest production activities generate two-thirds of the jobs in the state's agricultural industry, projected as ranging from 13,220 to 15,066 jobs, with an average of 14,095 across the three models used. Primary agricultural processing activities add another 6,023 to 8,476 jobs, with an average of 5,363 (Table 2). When comparing sectors, the highest job generator is greenhouse, nursery, floriculture, and sod production (4,233

to 5,909 jobs), followed by fluid milk and butter manufacturing; support activities for agriculture and forestry; ice cream and frozen dessert manufacturing; all other crop farming; fruit and vegetable canning, pickling, and drying; fruit farming; cheese manufacturing; and wineries.

Figure 6 reveals interesting information about the labor intensity of the agricultural and primary processing sectors. In Connecticut, the agricultural production sector generates between 7.7 and 32.9 jobs per million dollars in sales, compared to the 5.1 to 9.8 jobs per million dollars in sales generated by agricultural processing. Across sectors, the highest job creators per million dollars in sales are all other crop farming (14.2 to 51.5 jobs), commercial fishing (16.4 to 35.6), support activities for agriculture and forestry (23.7 to 28.1 jobs), and fruit farming (19.2 to 30.0 jobs). It should be noted that the higher labor intensities in farming, relative to other agricultural sectors or other sectors in the state economy, may be due in part to seasonal farm jobs that peak at harvesting time.

Table 2 – Statewide Impact on Jobs

Activity	Number of Jobs		
	RIMS II	IMPLAN	REMI
Agricultural and forest production			
Oilseed farming	3	3	-
Grain farming	121	145	-
Vegetable and melon farming	624	658	-
Fruit farming	812	1,269	-
Tree nut farming	61	71	-
Greenhouse, nursery, floriculture, and sod	5,909	4,233	-
Tobacco farming	503	734	-
All other crop farming	472	1,715	-
Cattle ranching and farming	209	520	-
Dairy cattle and milk production	812	627	-
Poultry and egg production	858	450	-
Animal production (except cattle, poultry, and eggs)	547	1,237	-
Commercial logging	388	793	-
Sawmills	431	619	-
Wood preservation	66	64	-
Commercial fishing	254	553	-
Commercial hunting and trapping	30	49	-
Support activities for agriculture and forestry	1,121	1,326	-
Total for agricultural and forest production	13,220	15,066	14,030
Primary agricultural processing			
Fruit and vegetable canning, pickling, and drying	1,308	859	-
Fluid milk and butter manufacturing	2,311	1,610	-
Cheese manufacturing	1,181	632	-
Ice cream and frozen dessert manufacturing	1,380	937	-
Animal (except poultry) slaughtering and processing	190	282	-
Meat processed from carcasses	715	669	-
Poultry processing	140	127	-
Seafood product preparation and packaging	274	273	-
Wineries	978	635	-
Total for primary agricultural processing	8,476	6,023	6,977
Total for the agricultural industry	21,696	21,090	21,007
Some special sub-sectors			
Cut Christmas trees	92	335	-
Maple syrup production	24	86	-
Horses and other equine production	120	272	-
Aquaculture	359	813	-
Direct marketed sales to consumers	628	662	-
Agritourism	186	88	-
Honey	8	17	-

Sector by sector impacts were not estimated for the REMI methodology due to time and budget constraints, since this task would require a detailed analysis of each sector.

Figure 6

Labor Intensity of Agricultural and Primary Processing Sectors

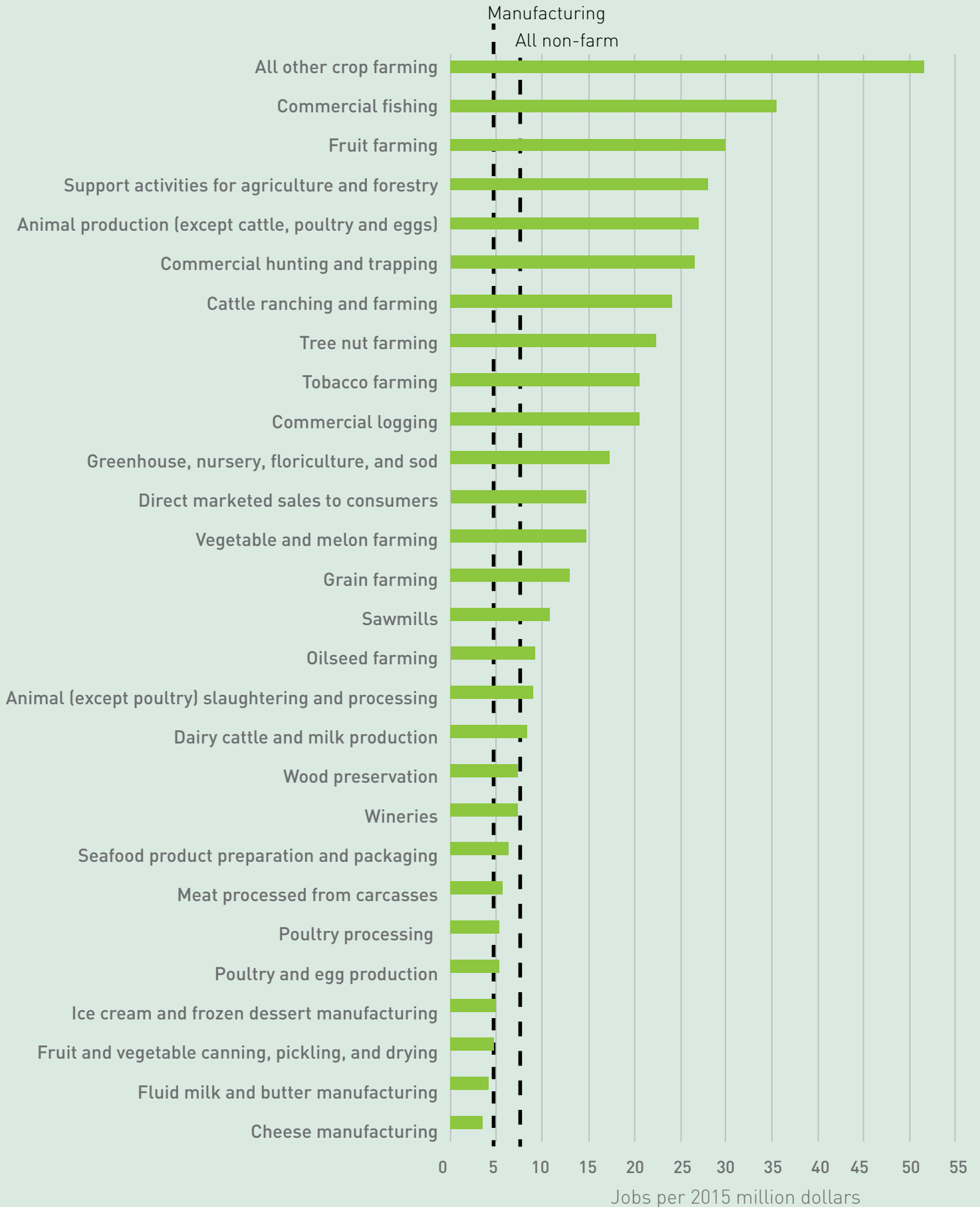


Table 3 – Statewide Impact on Wages (Labor income)

		2015 million dollars		
Sector		RIMS II	IMPLAN	REMI
Agricultural and forest production	Oilseed farming	0.1	0.1	-
	Grain farming	3.7	3.2	-
	Vegetable and melon farming	17.4	21.6	-
	Fruit farming	19.8	26.2	-
	Tree nut farming	1.5	2.1	-
	Greenhouse, nursery, floriculture, and sod	156.1	155.7	-
	Tobacco farming	15.0	24.2	-
	All other crop farming	14.1	20.2	-
	Cattle ranching and farming	5.6	4.5	-
	Dairy cattle and milk production	25.6	20.3	-
	Poultry and egg production	25.8	19.8	-
	Animal production (except cattle, poultry, and eggs)	14.4	14.8	-
	Commercial logging	19.0	27.9	-
	Sawmills	17.5	35.9	-
	Wood preservation	2.7	4.4	-
	Commercial fishing	7.1	11.7	-
	Commercial hunting and trapping	0.8	1.3	-
Support activities for agriculture and forestry	39.3	40.6	-	
	Total for agricultural and forest production	385.5	434.6	472.5
Primary agricultural processing	Fruit and vegetable canning, pickling, and drying	61.0	57.1	-
	Fluid milk and butter manufacturing	114.4	103.3	-
	Cheese manufacturing	51.8	38.0	-
	Ice cream and frozen dessert manufacturing	61.2	62.7	-
	Animal (except poultry) slaughtering and processing	7.3	7.2	-
	Meat processed from carcasses	27.4	25.3	-
	Poultry processing	6.4	7.5	-
	Seafood product preparation and packaging	12.3	13.7	-
	Wineries	31.5	32.8	-
	Total for primary agricultural processing	373.4	347.5	426.6
	Total for the agricultural industry	758.9	782.1	899.1
Some special sub-sectors	Cut Christmas trees	2.7	3.9	-
	Maple syrup production	0.7	1.0	-
	Horses and other equine production	3.2	3.3	-
	Aquaculture	9.5	9.7	-
	Direct marketed sales to consumers	17.5	21.7	-
	Agritourism	5.1	2.6	-
	Honey	0.2	0.2	-

Subsector impacts were not estimated for the REMI methodology due to time and budget constraints, since this task would require a detailed analysis of each subsector.

Wage Impacts

Table 3 shows that the following sectors add significantly to wages within the state: greenhouse, nursery, floriculture, and sod production; fluid milk and butter manufacturing; ice cream and frozen dessert manufacturing; fruit and vegetable canning, pickling, and drying; and cheese manufacturing. Agricultural and forestry production generated between \$386 and \$473 million in wages in 2015, while the agricultural processing industry generated between \$348 and \$427 million. Wages generated by the agricultural industry as a whole are estimated to have been between \$759 and \$899 million in 2015.

Non-traditional Impacts

Carbon sequestration in agricultural soil

We estimate that all the agricultural land in Connecticut sequestered approximately 14,900 metric tons of CO₂ in 2015. This is equivalent to taking approximately 3,200 average passenger vehicles off the road. Assuming the social cost of carbon to be \$13 to \$120 per metric ton of CO₂, the total value of the externalities averted through carbon sequestration by agriculture in Connecticut is between \$187,000 and \$1.8 million per year (in 2015 dollars).

Photo by Katie Molodich at Molodich Farms, Sterling, CT

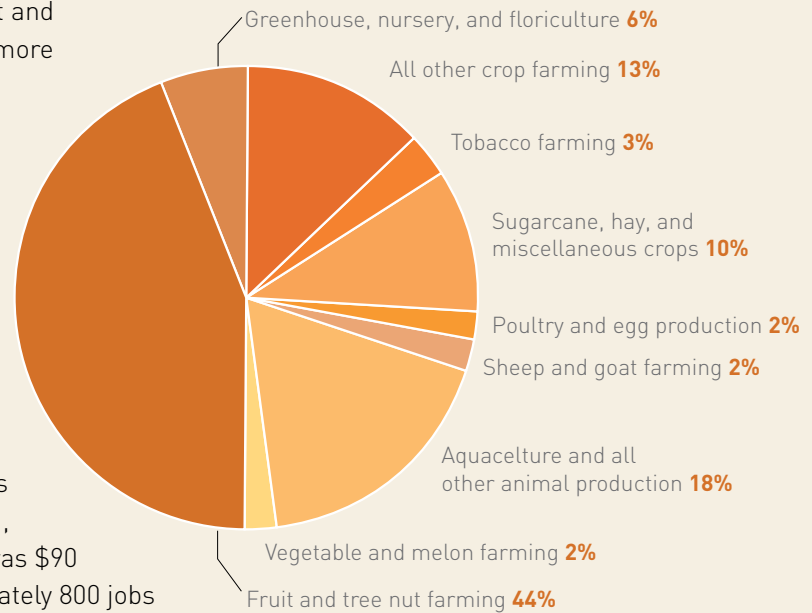


Local food systems and agritourism

Local food is becoming more popular in Connecticut and throughout the United States. Consumers can now more easily purchase locally grown agricultural products directly from farmers at farmers' markets, farm stands, or through Community Supported Agricultural (CSA) programs. Consumers can also tour agricultural areas to see farms (e.g., wine routes), participate in farm activities, such as pick your own (e.g., apples and berry farms) and entertainment (e.g., farm-to-table events), and learn about farm and sustainability practices.

Given the growth in this sector and its importance to consumer health and well-being, we estimated its economic impact in Connecticut. As noted in Table 1, total output from local food sales and agritourism was \$90 million in 2015, and these sectors created approximately 800 jobs in the state and almost \$30 million in wages. Figure 7 shows the value of Connecticut's agritourism sector by crop type. Apple and berry picking is a popular activity in the northeastern U.S., and fruit and tree nut farming makes up almost half the revenue generated by the agritourism sector in Connecticut. Livestock production accounts for the next largest share (22%) of revenue generated from this industry.

Figure 7 Value of Agritourism by Crop Type



Willingness to pay for agricultural land in open space

Consumers value and are willing to pay for the scenic beauty and environmental benefits of keeping land in agricultural production. Some studies have concluded that, on average, households in Connecticut are willing to pay \$0.31 per acre per year for agricultural open space (Johnston, Warner-Camson and Duke, 2007). Willingness to pay varies, however, in significant ways both geographically and by household socio-demographic characteristics (Johnston and Duke, 2007, Johnston and Duke, 2009). Further study is needed to more accurately estimate the willingness to pay of Connecticut households in different parts of the state, depending on proximity to agricultural land and socio-economic characteristics such as income and educational status.



CONCLUSION

This study is the second comprehensive effort to evaluate the impact of the Connecticut agricultural industry on the state economy, defining this industry as encompassing agricultural and forestry production and primary agricultural processing. The first study was conducted in 2010 with 2007 data (Lopez, et al., 2010), using the same sectors and three economic models (IMPLAN, RIMS II, and REMI).

In 2015, the Connecticut agricultural industry contributed up to **\$4.05 billion to the state economy and generated approximately 21,000 jobs.** Beyond this, the industry contributed significantly to enhancing the quality of life for Connecticut residents by providing important environmental and social benefits, including local production of healthy foods such as fruit and vegetables, agritourism, carbon sequestration, and open space benefits.

Compared to 2007 (Lopez et al., 2010), the results here show that although the impact in statewide nominal dollar sales increased from \$3.51 to \$4.05 billion (using the REMI results), aggregate real output impact declined slightly in real dollars by 2.6% or 0.32% annually, while the change in employment impact was flat. Using IMPLAN results, aggregate real output impact increased slightly in real dollars by 1% or 0.125% annually.² This finding of sluggish to a slight decline in impacts is consistent with the rather moderate increase in direct sales for the industry as a whole (14.9% increase between 2007 and 2015 in nominal dollars).³ While the total size of the industry and its impacts on the state economy remained about the same, we observe an important, ongoing restructuring towards specialty crops and sectors that add value beyond the farm gate.



From a policy perspective, further study and policy makers' attention are needed to explore policy instruments to preserve and spur the growth of the agricultural industry in Connecticut. These policies might include the use of tax credits and subsidies to enhance economic viability, and possible removal of regulations that may be stunting growth and investment returns in agricultural activities. Connecticut's agricultural industry will continue along the diverse, dynamic, and non-traditional path that sets it apart from typical agricultural industries in other states. With the proper mix of public and private policies, an efficient, economically viable, and consumer-oriented industry could be well-positioned to resume a robust growth trajectory well into the 21st century.

² These changes are calculated using the Personal Consumption Expenditures (PCE) index internal to the REMI model, which showed price increases of 18.8% between 2007 and 2015. Note that REMI uses this PCE index to adjust impact values to 2015 using a base year of 2009 and, thus, it is the appropriate index for comparison across years. Note also that between 2007 and 2015 the consumer price index for the Northeast region increased by 15.3%, implying that the change in REMI's sales impact slightly exceeded consumer price inflation (by 0.9%) between those two years.

³ Changes in total direct sales for the agricultural industry (14.9%) were below the inflation rate (15.3%) between 2007 and 2015. Changes in the total RIMS II's sales impacts remained below inflation or changes in the PCE index.



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Table A1: 2015 Data and Multipliers for the Connecticut Agricultural Industry

Sector	Direct Sales (\$2007 million)	IMPLAN Multipliers		
		Output Multiplier	Employment Multiplier (Jobs/ million dollars)	Wages Multiplier
Oilseed farming	0.32	1.766	9.309	0.271
Grain farming	11.10	1.743	13.084	0.291
Vegetable and melon farming	44.05	1.695	14.939	0.489
Fruit farming	42.36	1.759	29.959	0.620
Tree nut farming	3.17	1.732	22.464	0.660
Greenhouse, nursery, floriculture, and sod	243.05	1.682	17.417	0.641
Tobacco farming	35.46	1.735	20.694	0.684
All other crop farming	33.27	1.790	51.554	0.608
Cattle ranching and farming	21.47	1.640	24.227	0.208
Dairy cattle and milk production	73.65	1.637	8.509	0.276
Poultry and egg production	84.34	1.536	5.336	0.235
Animal production (except cattle, poultry, & eggs)	45.55	1.659	27.158	0.326
Commercial logging	38.51	1.629	20.587	0.724
Sawmills	56.64	2.027	10.937	0.634
Wood preservation	8.67	1.894	7.400	0.504
Commercial fishing	15.53	1.454	35.583	0.752
Commercial hunting and trapping	1.83	1.694	26.591	0.723
Support activities for agriculture and forestry	47.23	1.664	28.067	0.860
Total for agricultural and forest production	806.20	1.697	19.173	0.550
Fruit and vegetable canning, pickling, and drying	177.41	1.565	4.842	0.322
Fluid milk and butter manufacturing	381.08	1.621	4.225	0.271
Cheese manufacturing	177.37	1.550	3.563	0.214
Ice cream and frozen dessert manufacturing	189.33	1.530	4.948	0.331
Animal (except poultry) slaughtering and proc.	30.94	1.641	9.117	0.232
Meat processed from carcasses	116.11	1.438	5.764	0.218
Poultry processing	23.52	1.422	5.397	0.320
Seafood product preparation and packaging	42.37	1.524	6.434	0.323
Wineries	85.83	1.689	7.395	0.382
Total for primary agricultural processing	1,223.96	1.569	4.921	0.284
Total for the agricultural industry	2,030.16	1.6	10.5	0.4
Cut Christmas trees	6.49	1.790	51.554	0.608
Maple syrup production	1.66	1.790	51.554	0.608
Horses and other equine production	10.03	1.659	27.158	0.326
Aquaculture	29.93	1.659	27.158	0.326
Direct marketed sales to consumers	44.34	1.695	14.939	0.489
Agritourism	9.48	1.712	9.309	0.271
Honey	0.64	1.659	27.158	0.326

	RIMS II Multipliers		
	Output Multiplier	Employment Multiplier (Jobs/ million dollars)	Wages Multiplier
	1.697	10.907	0.334
	1.697	10.907	0.334
	1.480	14.160	0.395
	1.543	19.165	0.468
	1.543	19.165	0.468
	1.869	24.313	0.642
	1.594	14.179	0.423
	1.594	14.179	0.423
	1.399	9.714	0.263
	1.591	11.027	0.348
	1.525	10.171	0.306
	1.375	11.999	0.317
	1.513	10.066	0.494
	1.552	7.616	0.309
	1.552	7.616	0.309
	1.583	16.371	0.455
	1.583	16.371	0.455
	1.804	23.731	0.831
	1.653	16.624	0.484
	1.799	7.372	0.344
	1.622	6.064	0.300
	1.581	6.658	0.292
	1.722	7.288	0.323
	1.343	6.157	0.236
	1.343	6.157	0.236
	1.490	5.946	0.273
	1.525	6.457	0.291
	1.796	11.391	0.368
	1.630	6.925	0.305
	1.6	10.7	0.4
	1.594	14.179	0.423
	1.594	14.179	0.423
	1.375	11.999	0.317
	1.375	11.999	0.317
	1.480	14.160	0.395
	1.908	19.625	0.535
	1.375	11.999	0.317

Notes: For REMI, the imputed output multipliers (ratio of statewide output impact to the direct sales of agriculture) for agricultural and forest production, primary agricultural processing, and the entire agricultural industry are 2.48, 1.72, and 2.01, respectively. The imputed employment multipliers (ratio of statewide employment impact to the direct sales of agriculture) are 17.98, 5.24, and 10.19, respectively. Note that direct employment data was not used in the calculations.

Table A2: Percent Change in Impact on Statewide Sales and Jobs from 2007 to 2015 (IMPLAN Results Only).

Sector	% change in sales	% change in jobs	
Agricultural and forest production	Oilseed farming	n/a	n/a
	Grain farming	821%	246%
	Vegetable and melon farming	141%	152%
	Fruit farming	0%	108%
	Tree nut farming	n/a	n/a
	Greenhouse, nursery, floriculture, and sod	10%	1%
	Tobacco farming	-29%	-54%
	All other crop farming	23%	361%
	Cattle ranching and farming	132%	219%
	Dairy cattle and milk production	24%	-37%
	Poultry and egg production	14%	-24%
	Animal production (except cattle, poultry, & eggs)	26%	-19%
	Commercial logging	-17%	37%
	Sawmills and wood preservation	70%	61%
	Commercial fishing	-47%	-22%
	Commercial hunting and trapping	-37%	-3%
	Support activities for agriculture and forestry	88%	-17%
Total for agricultural and forest production	12%	10%	
Primary agricultural processing	Fruit and vegetable canning, pickling, and drying	-15%	-3%
	Fluid milk and butter manufacturing	199%	102%
	Cheese manufacturing	-32%	-56%
	Ice cream and frozen dessert manufacturing	21%	19%
	Animal (except poultry) slaughtering and proc. meat processed from carcasses	-17%	-18%
	Poultry processing	23%	-5%
	Seafood product preparation and packaging	56%	58%
	Wineries	130%	165%
Total for primary agricultural processing	22%	7%	

Notes: n/a means that the 2007 value was not available or reported in the 2010 report. Sawmills and wood preservation were one sector in 2007, so we combine them here to calculate % change values. Animal (except poultry) slaughtering/processing and meat processed from carcasses constituted one sector in the 2010 report, so we combined them here to calculate % change values.

Table A3: Description of Sectors Included in the Study

IMPLAN sector	NAICS code	Sector	Description
1	111120, 111110	Oilseed farming	Soybean, canola, flaxseed, mustard, oilseeds, rapeseed, safflower, sesame, and sunflower farming.
2	111130, 111140, 111150, 111160, 111190	Grain farming	Bean cowpea, garbanzo, lentil, lima bean, pea, wheat, corn, popcorn, rice, oilseed and grain combination, barley, broomcorn, buckwheat, milo, oat, rye, sorghum, and wild rice farming.
3	111200	Vegetable and melon farming	Growing root and tuber crops or edible plants and/or producing root and tuber or edible plant seeds
4	111300	Fruit farming	Apple orchards; grape vineyards; strawberry farming; berry (except strawberry) farming
6	111400	Greenhouse, nursery, floriculture, and sod	Growing crops of any kind under cover and/or growing nursery stock and flowers
7	111910	Tobacco farming	Tobacco farming, field and seed production
10	111991, 111992, 111998	All other crop farming	Hay farming; all other miscellaneous crop farming (e.g. aloe)
11	112100	Cattle ranching and farming	Raising cattle for both milking and meat production
12	112120	Dairy cattle and milk production	Milking dairy cattle
13	112300	Poultry and egg production	Breeding, hatching, and raising poultry for meat or egg production
14	112900	Animal production, except cattle and poultry and eggs	Pigs and hogs, goats, sheep and lambs, mohairs, aquaculture (including finfish and shellfish), frogs, turtles, horses, donkeys and burros, ponies, foxes, fur bearing animals, mink, rabbit, chinchilla, alpaca, birds for sale, bison, pet breeding animals (i.e. dogs, cats, etc.), buffalo, combination livestock, crickets, deer, earthworms, elk, laboratory animal production, snakes, adornment birds (i.e. swans, peacocks), llamas.
15	113100, 113200	Forest nurseries, forest products, and timber tracts	Operating timber tracts for the purpose of selling standing timber; forest nurseries and gathering of forest product tracts
16	113300	Commercial Logging	Cutting timber; cutting and transporting timber; producing wood chips in the field
17	114100	Commercial Fishing	Commercial catching or taking of finfish, shellfish, or miscellaneous marine products from a natural habitat
18	114200	Commercial hunting and trapping	Commercial hunting and trapping; operating commercial game preserves, such as game retreats; operating hunting preserves
19	115000	Support activities for agriculture and forestry	Crop harvesting primarily by machine, soil preparation, farm labor contracting, farm management services

Agricultural and forest production

Primary agricultural processing

IMPLAN sector	NAICS code	Sector	Description
134	321113	Sawmills	Sawing dimension lumber, boards, beams, timbers, poles, ties shingles, shakes, siding, and wood chips from logs or bolts.
135	321114	Wood preservation	Treating wood sawed, planed, or shaped in other establishments with creosote or other preservatives; and sawing round wood poles, pilings, and posts and treating them with preservatives.
81	311420	Fruit and vegetable canning, pickling, and drying	Manufacturing canned, pickled, and dried fruits, vegetables, and specialty foods
84, 85	311511, 311512	Fluid milk and butter manufacturing	Manufacturing processed milk product, such as pasteurized milk or cream and sour cream and/or manufacturing fluid milk dairy substitutes from soybeans and other nondairy substances; creamery butter manufacturing
86	311513	Cheese manufacturing	Manufacturing cheese products (except cottage cheese) from raw milk and/or processed milk products and/or manufacturing cheese substitutes from soybean and other nondairy substances
88	311520	Ice cream and frozen dessert manufacturing	Manufacturing ice cream, frozen yogurts, frozen ices, sherbets, frozen tofu, and other frozen desserts (except bakery products)
89	311611	Animal (except poultry) slaughtering and processing	Slaughtering animals (except poultry and small game); meat processing from carcasses; rendering and meat by-product processing
90	311612	Meat processed from carcasses	Processing or preserving meat and meat byproducts (except poultry and small game) from purchased meats. Cutting/packing of meats (i.e. boxed meats) from purchased meats.
92	311615	Poultry processing	(1) Slaughtering poultry and small game and/or (2) preparing processed poultry and small game meat and meat byproducts
93	311700	Seafood product preparation and packaging	Canning seafood (including soup); smoking, salting, and drying seafood; eviscerating fresh fish by removing heads, fins, scales, bones, and entrails; shucking and packing fresh shellfish; processing marine fats and oils; and freezing seafood
109	312130	Wineries	Growing grapes and manufacturing wines and brandies; manufacturing wines and brandies from grapes and other fruits grown elsewhere; blending wines and brandies

Notes: The following agricultural production sectors were excluded from the analysis because no direct sales were reported for them in 2015: cotton farming, and sugar cane and sugar beet farming. Only the agricultural processing sectors shown in the table above were included in the analysis because these processing activities have strong linkages with agricultural production in the state. Thus, the following food processing industries in Connecticut were excluded from this study even though these industries are active in the state as of 2015: (1) other animal food manufacturing, (2) fats and oils refining and blending, (3) breakfast cereal manufacturing, (4) chocolate and confectionery manufacturing from cacao beans, (5) confectionery manufacturing from purchased chocolate, (6) non-chocolate confectionery manufacturing, (7) frozen food manufacturing, (8) bread and bakery product manufacturing, (9) cookie, cracker, and pasta manufacturing, (10) snack food manufacturing, (11) coffee and tea manufacturing, (12) flavoring syrup and concentrate manufacturing, (13) seasoning and dressing manufacturing, (14) all other food manufacturing, (15) soft drink and ice manufacturing, (16) breweries, (17) distilleries, and (18) tobacco product manufacturing (e.g., cigarettes and chewing tobacco). A more detailed description of the sectors can be found at: <http://support.implan.com>



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