Massachusetts Economic Analysis of Animal Agriculture: 2012-2022

September 2023

Prepared For:

UNITED SOYBEAN BOARD™

Prepared By:

Decision Innovation Solutions

Contents

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Massachusetts Executive Summary

The use of SBM as a key feed ingredient is an important part of Massachusetts animal agriculture. While the degree to which animal agriculture utilizes this versatile feed ingredient has fluctuated with time, it remains a key driver of animal agriculture's success in the State of Massachusetts. The success of Massachusetts animal agriculture in turn has a large impact on the rest of the state and regional economies. For example, in the State of Massachusetts during 2022 animal agriculture contributed:

- $291.7 million in economic output
- 1,502 jobs
- $60.1 million in earnings
- $15.2 million in income taxes paid at local, state, and federal levels
- $40.1 million in the form of property taxes

Massachusetts's animal agriculture consumed almost 13.7 thousand tons of SBM in 2022. This SBM was fed primarily to:

- Companion Animals (6.4 thousand tons)
- Dairy Cows (2.8 thousand tons)
- Egg-Laying Hens (2.3 thousand tons)

This report examines animal agriculture in Massachusetts over the last decade. While this analysis is certainly instructive and allows improved understanding of animal agriculture's impact during that time, as the next decade unfolds in Massachusetts, many opportunities and challenges will arise. And, if past is prologue, animal agriculture will continue to be a major contributor to the economic well-being of the people of Massachusetts and beyond.

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Massachusetts Economic Impact of Animal Agriculture

Animal agriculture is an important part of Massachusetts's economy. In 2022, Massachusetts's animal agriculture contributed the following to the economy:

- About $291.7 million in economic output
- $60.1 million in household earnings
- 1,502 jobs
- $15.2 million in income taxes

And the animal agriculture sector has shown some change during challenging economic times. During the last decade Massachusetts's animal agriculture has:

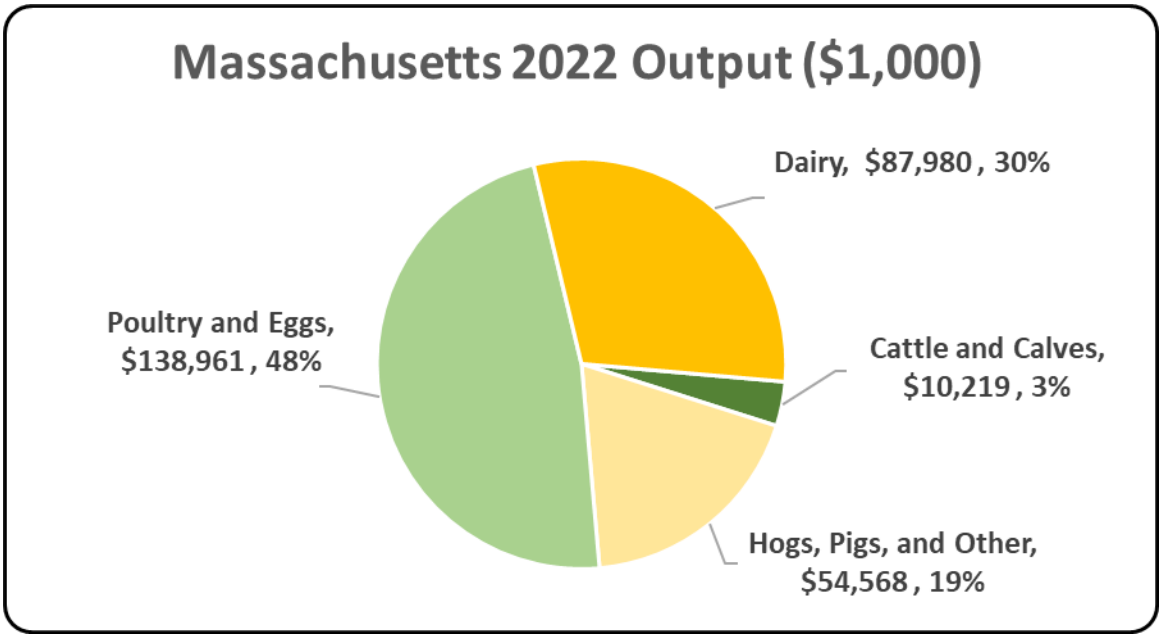
- Increased economic output by $31.4 million
- Boosted household earnings by $6.4 million
- Added 136 jobs
- Paid $1.6 million more in income taxes

Below is a table which demonstrates this decade of change.

Measure		2022		Change 2012-2022	% Change 2012-2022
Output ($1,000)	$	291,727	$	31,363	12.05%
Earnings ($1,000)	$	60,141	$	6,433	11.98%
Employment (Jobs)		1,502		136	9.99%
Income Taxes Paid ($1,000)	$	15,155	$	1,621	11.98%
Property Taxes Paid in 2017 ($1,000)	$	40,078			

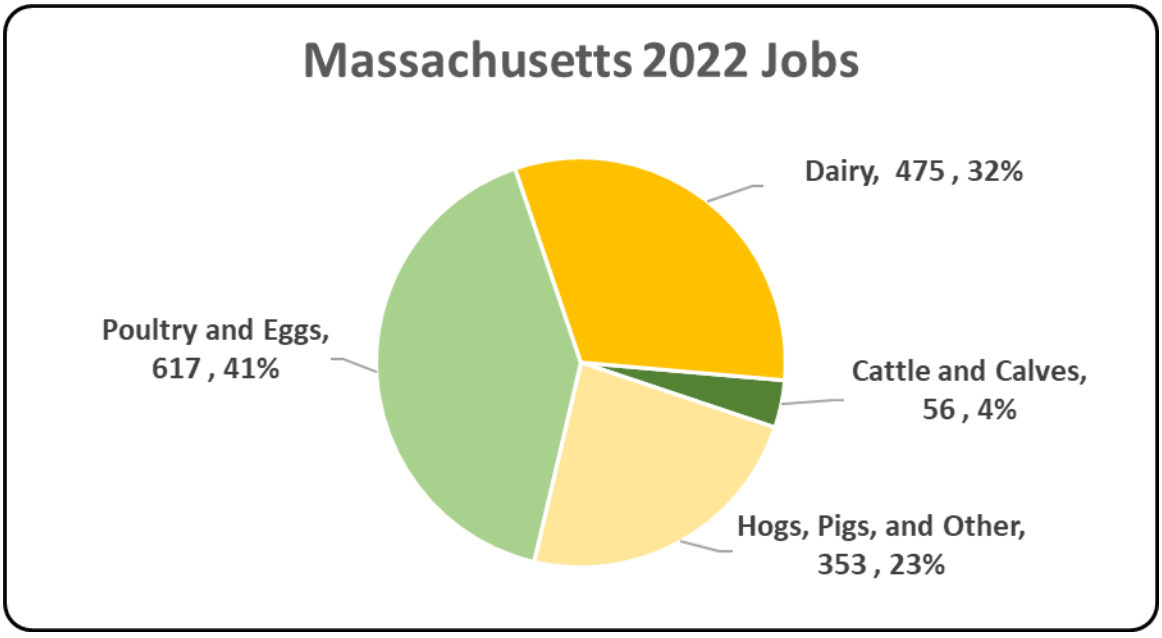
Massachusetts Output

"Output" refers to the total value of all the output (production or sales) of a study area and/or industry within a study area and was calculated using RIMS II multipliers. This is a gross number that does not make any deductions for the cost or origination of inputs that were used in the production process. The figure illustrates the impact of animal agriculture to the Massachusetts economy. Animal agriculture's impact on Massachusetts total economic output is about $291.7 million.



Massachusetts Jobs

"Jobs" represents an estimate of the number of full or part-time positions (jobs) currently filled in an area and/or industry. The figure illustrates the contribution to Massachusetts in terms of animal agriculture jobs. As shown, animal agriculture contributes significantly to Massachusetts total jobs, contributing 1,502 jobs within and outside of animal agriculture.



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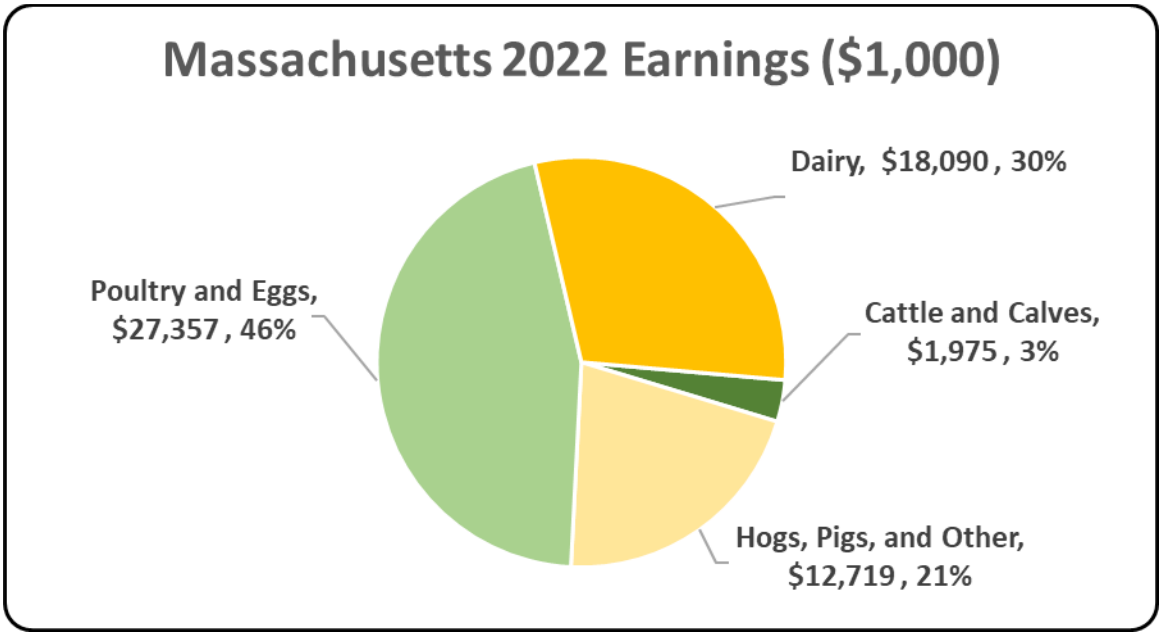
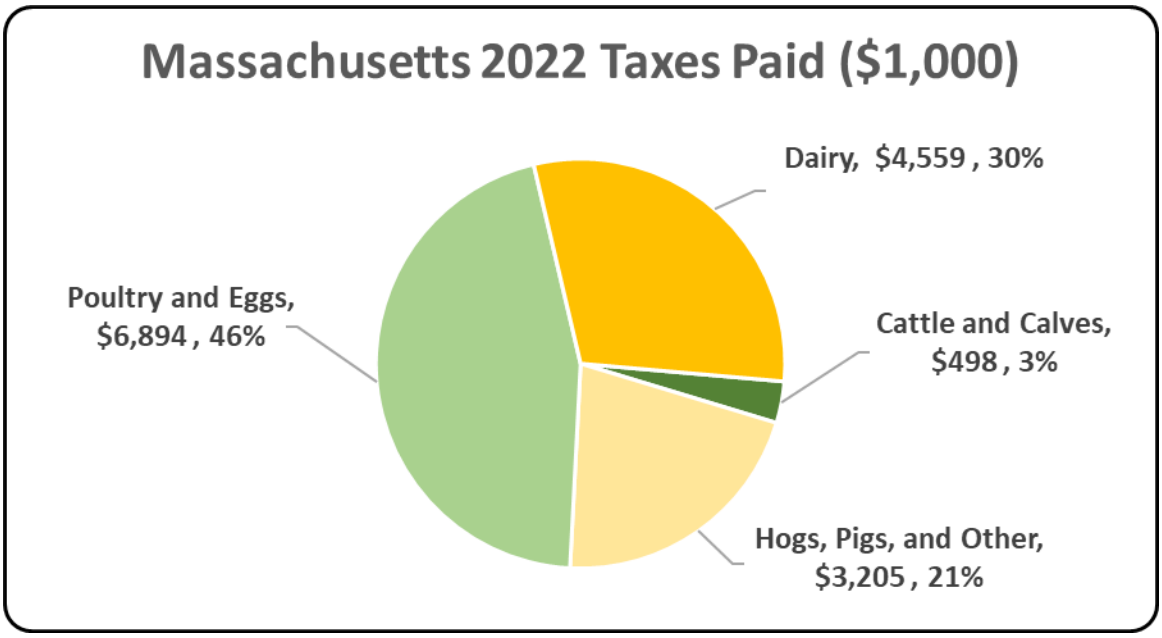
Massachusetts Earnings

Earnings includes wages and salaries plus proprietors' income, which is the net earnings of sole-proprietors and partnerships. The figure illustrates the impact of animal agriculture to the Massachusetts economy in terms of earnings. Massachusetts's animal agriculture contributed about $60.1 million to household earnings in 2022.



Massachusetts Taxes Paid by Animal Agriculture

Massachusetts's animal agriculture is also a significant source of tax revenue. In 2022, the state's animal agriculture industry paid about $15.2 million in income taxes at local, state, and federal levels. The 2017 Census of Agriculture estimated $40.1 million in property taxes paid by all of Massachusetts agriculture during 2017. Estimates of income taxes paid by animal agriculture are shown in the following chart.



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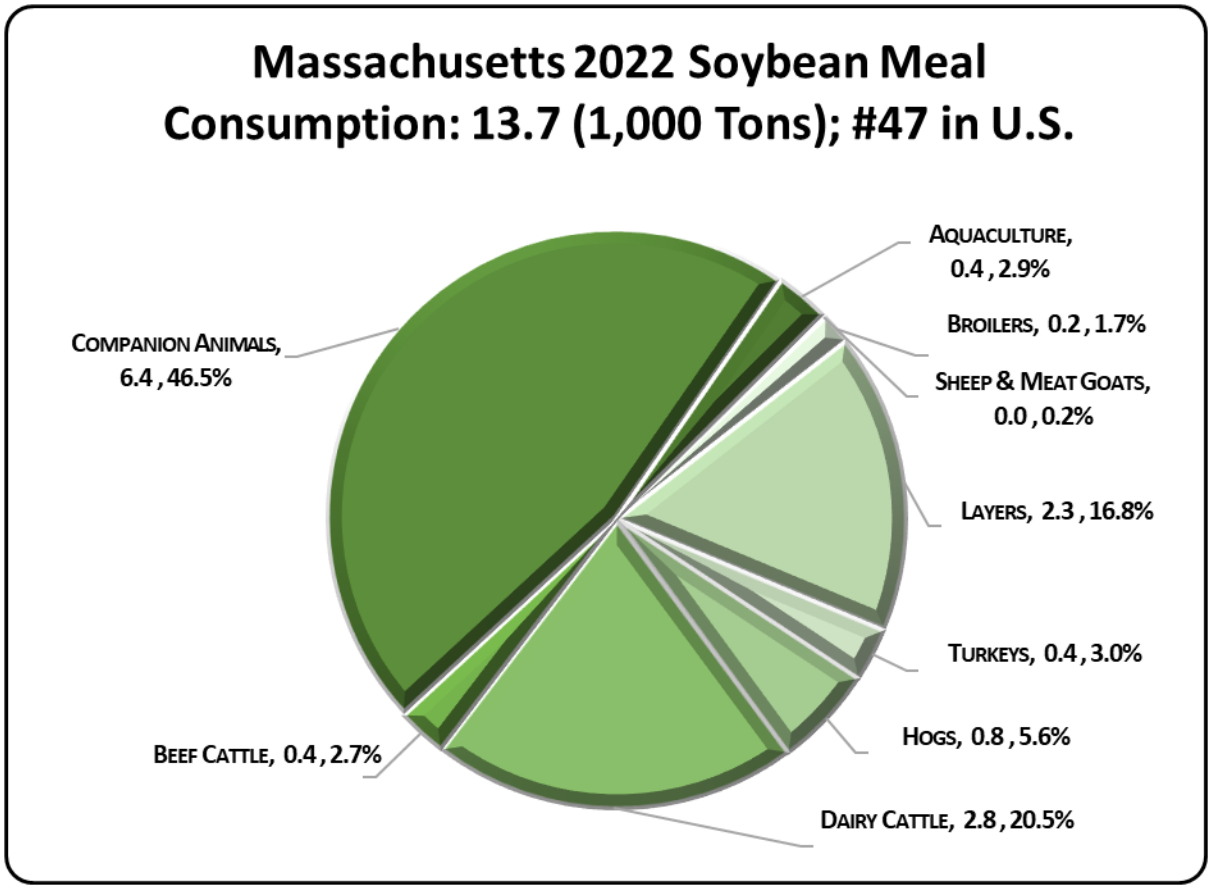
Massachusetts Animal Agriculture Soybean Meal Consumption

The choice to use SBM in animal agriculture is highly dependent upon nutritional requirements of animals (which would encompass varying life stages within an animal species), accessibility to various feed ingredients capable of competing with SBM (from both a nutritional and price standpoint), and consumer preferences which have influence on production practices.

Through in-depth conversations with many of the nation's top nutritionists and researchers from both private industry and public institutions, "bottom up" estimates of SBM usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of SBM used during the 2021-22 soybean marketing year by up to sixteen specific animal species has been estimated.

Massachusetts's animal agriculture consumed almost 13.7 thousand tons of SBM in 2022, placing the state as 47 in the nation in terms of SBM consumption (see figure below). Additionally, animal agriculture in Massachusetts consumed 1.7 thousand tons of soy hulls. The three segments of animal agriculture that led the state in estimated SBM consumption are:

1. Companion Animals (6.4 thousand tons)
2. Dairy Cows (2.8 thousand tons)
3. Egg-Laying Hens (2.3 thousand tons)

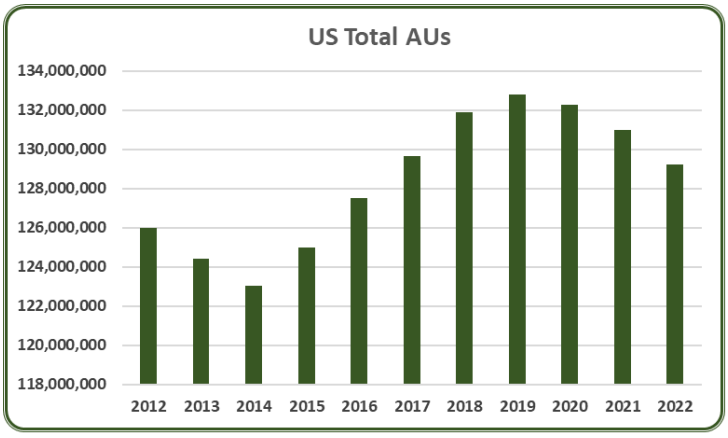


Massachusetts Animal Unit (AU) Trends

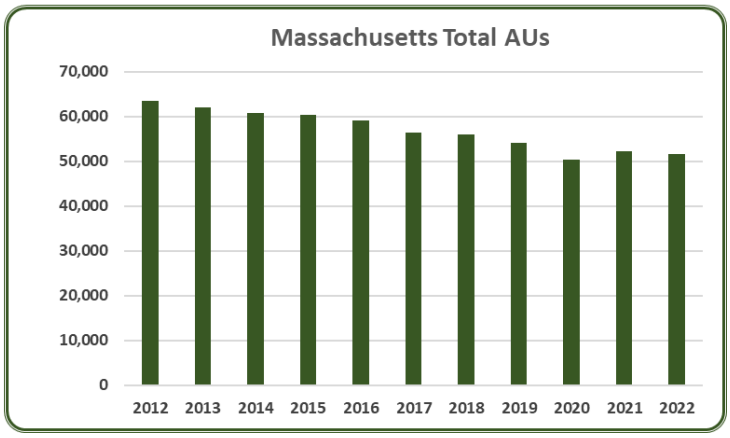
Over time, prices of feed, meat, eggs and milk, as well as levels of demand for these products in the U.S. and abroad have an impact on the size of animal agriculture in the state of Massachusetts. Due to this reality, using a single year to measure a sector's presence and strength can be misleading. The use of animal units allows for a more accurate comparison of differing sizes of livestock and poultry. This section is included to bring context to the question of what animal agriculture means to Massachusetts and to give perspective on Massachusetts's contribution to the nation's animal agriculture industry and beyond.

Like using a single year to measure the presence and strength of a sector, in some circumstances AUs can be misleading. This is because AUs do not reflect important considerations like increased weights, improved livability, increased laying potential, etc.

As shown in the accompanying charts and written commentary, certain components of animal agriculture are more present, and therefore more dominant than others. This is due primarily to geography (i.e., weather patterns and access to certain transportation hubs), proximity to high quality, relevant feed ingredients, and the local animal agriculture regulatory framework. In Massachusetts, the largest three segments of animal agriculture in terms of AUs during 2022 were: Dairy Cattle (21,294 AUs), Beef Cattle (14,199 AUs), and Horses (11,573 AUs). Total AUs in Massachusetts during 2022 were 51,643 AUs.



- In 2022, total AUs in the U.S. decreased by 1.4% to 129.2 million, continuing a downward trend that started in 2019. Nine out of the ten animal groups tracked saw a decrease, with the exception being broilers. Over 70% of the total decrease in AUs is due to lower beef cattle inventories.



- In 2022, Massachusetts had 51,643 total AUs, a 1.4% decrease from 2021. From 2012 to 2022, the average number of total AUs in Massachusetts was 57,053 AUs. Since 2012, total AUs in Massachusetts have decreased by 18.8%.

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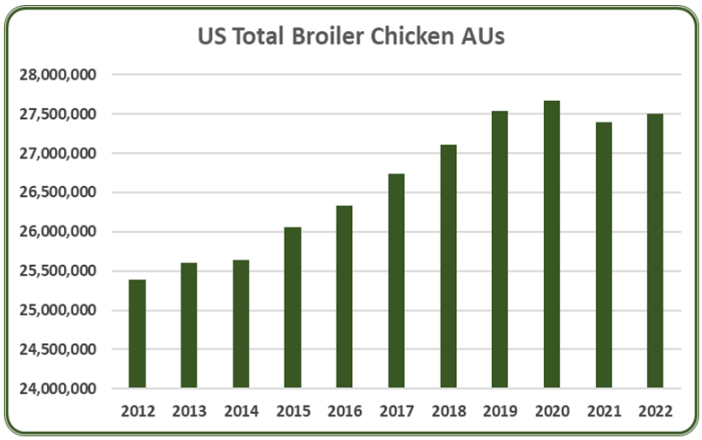
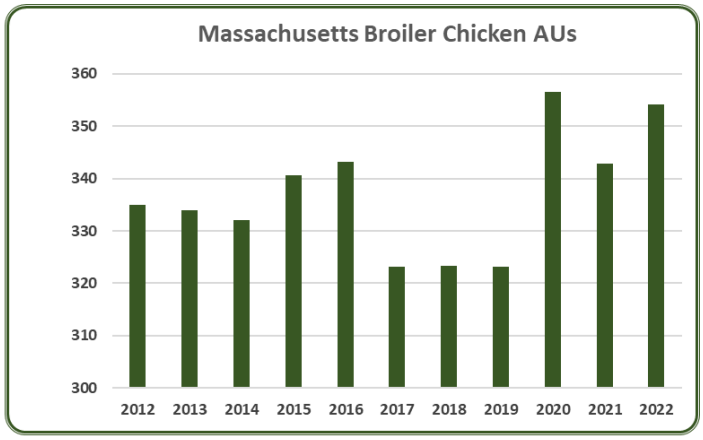
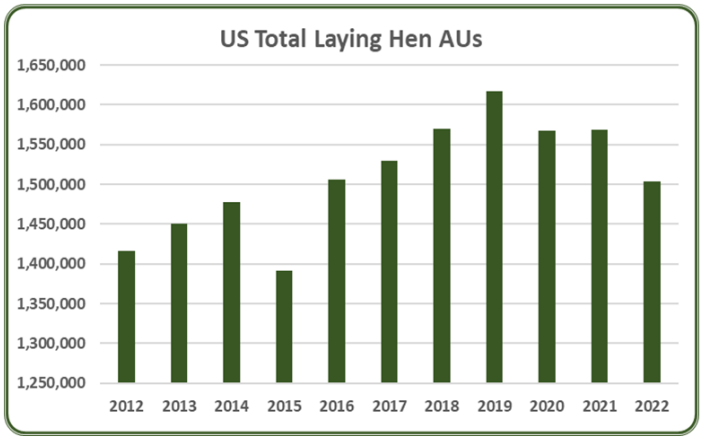


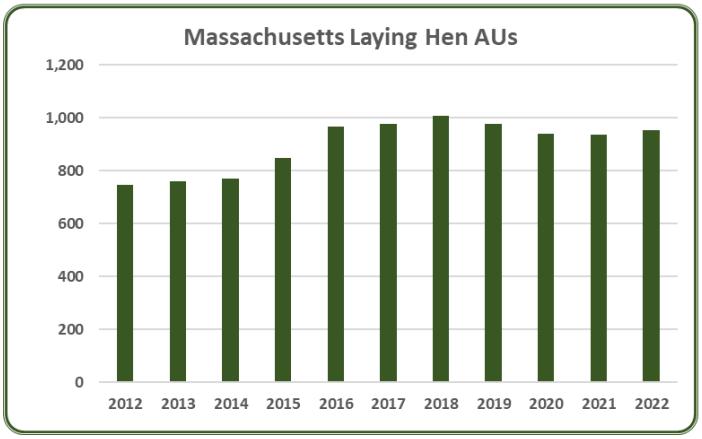
- From 2012 to 2022, broiler chicken AUs averaged 26.6 million across the U.S. Broiler AUs trended up and peaked in 2020 at 27.6 million. Broiler AUs are up 0.4% from 2021 and were the only animal group tracked here that increased compared to last year. Broilers make up about 21% of U.S. AUs.



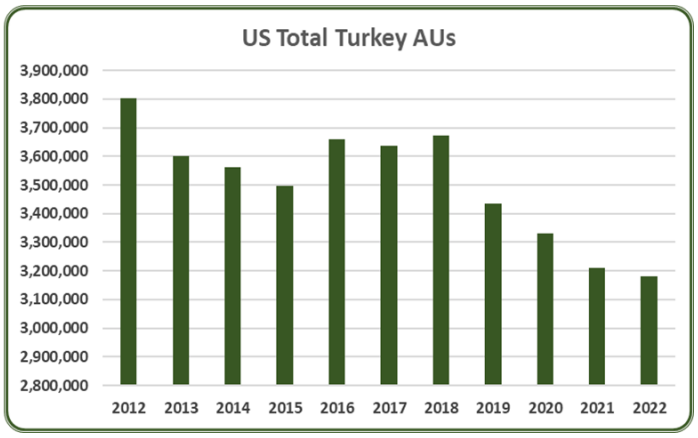
- In 2022, Massachusetts had 354 broiler AUs, a 3.3% increase from 2021. Broilers accounted for 0.7% of the total AUs (51,643) in Massachusetts. From 2012 to 2022, the average number of broiler AUs in Massachusetts was 337 AUs. Since 2012, broiler AUs have increased by 5.7%.



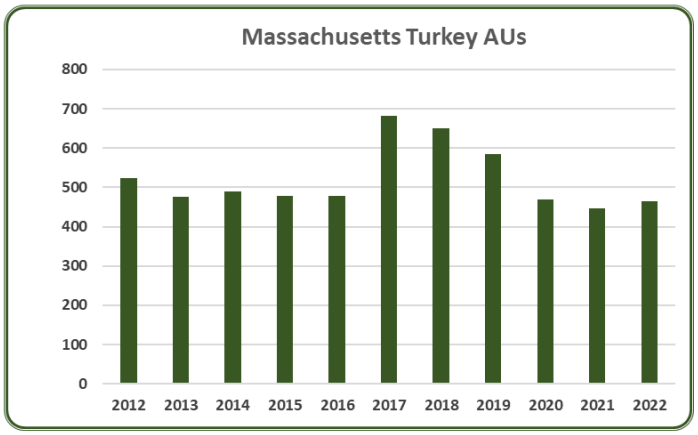
- From 2012 to 2022, U.S. layer AUs averaged 1.51 million. In 2022, layer AUs were 1.50 million, a 4.2% decrease from 2021. The 2022-23 Highly Pathogenic Avian Influenza (HPAI) outbreak contributed to this past year's decrease in layer AUs. Layers make up about 1% of U.S. AUs so large changes in layer AUs do not have a large impact on total AUs.



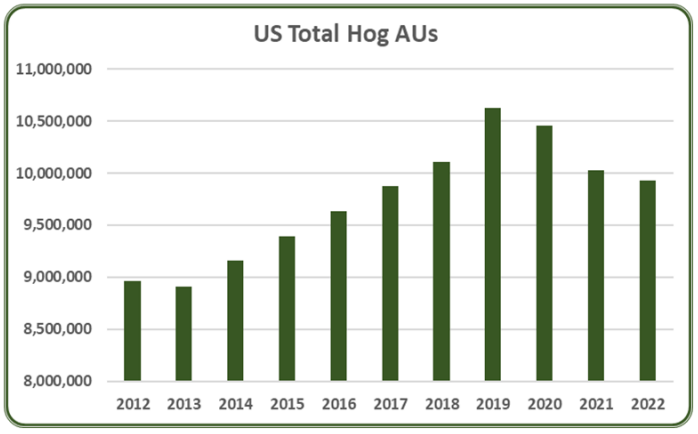
- In 2022, Massachusetts had 952 layer AUs, a 1.9% increase from 2021. Layers accounted for 1.8% of the total AUs (51,643) in Massachusetts. From 2012 to 2022, the average number of layer AUs in Massachusetts was 898 AUs. Since 2012, layer AUs have increased by 27.4%.



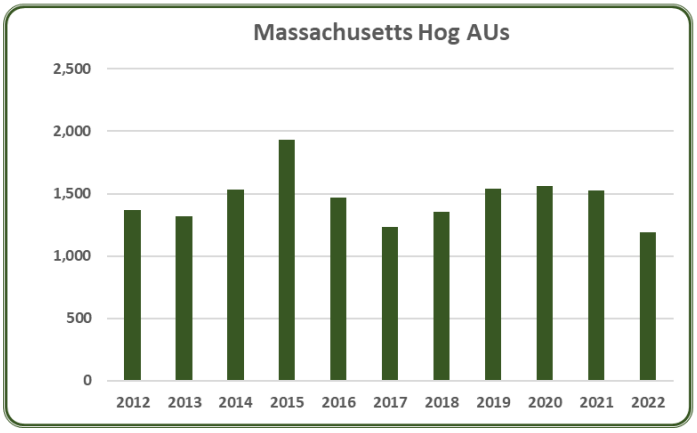
- In 2022, turkey AUs were at 3.18 million, a 0.9% drop from the previous year. This drop is surprisingly low considering the industry battled HPAI for most of 2022. Turkey AUs have been trending down since 2018. Turkey AUs represent about 2% of U.S. AUs, so like layers, large changes in turkey AUs do not cause large changes in total AUs.



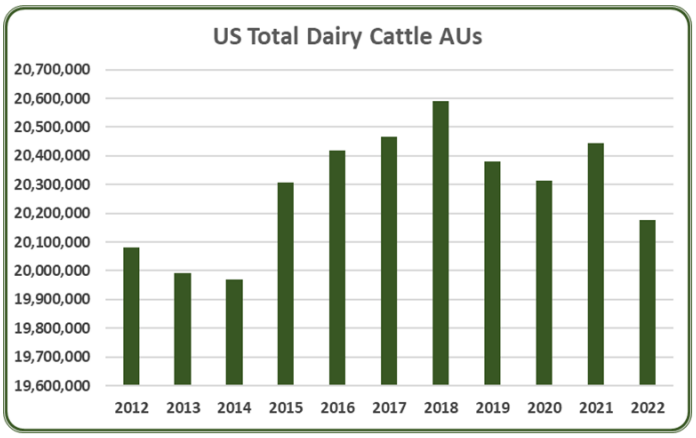
- In 2022, Massachusetts had 465 turkey AUs, a 4.3% increase from 2021. Turkeys accounted for 0.9% of the total AUs (51,643) in Massachusetts. From 2012 to 2022, the average number of turkey AUs in Massachusetts was 522 AUs. Since 2012, turkey AUs have decreased by 11%.



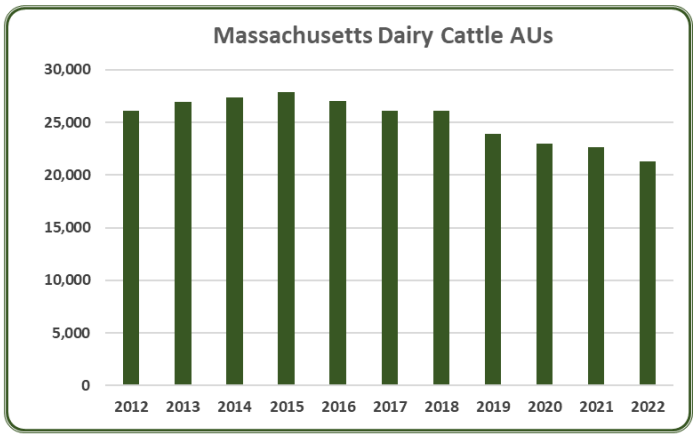
- In 2022, hog AUs totaled 9.93 million, a 1.0% drop from the previous year. From 2012 to 2022, hog AUs averaged 9.73 million. Hog AUs have been trending down since 2019 when they peaked at 10.62 million AUs. Hogs make up 7.70% of all AUs within the U.S.



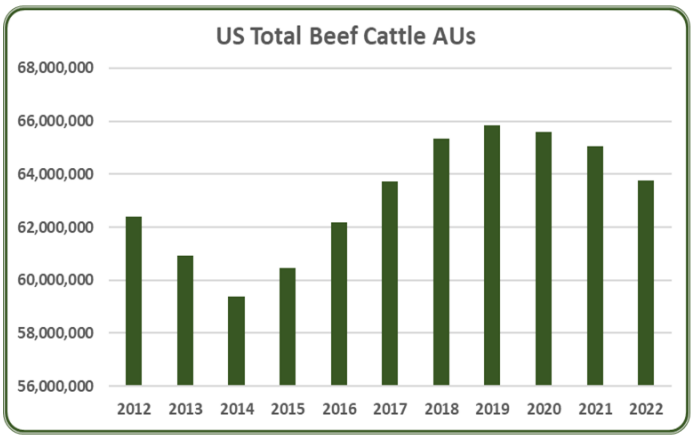
- In 2022, Massachusetts had 1,189 hog AUs, a 22.1% decrease from 2021. Hogs accounted for 2.3% of the total AUs (51,643) in Massachusetts. From 2012 to 2022, the average number of hog AUs in Massachusetts was 1,457 AUs. Since 2012, hog AUs have decreased by 13%.



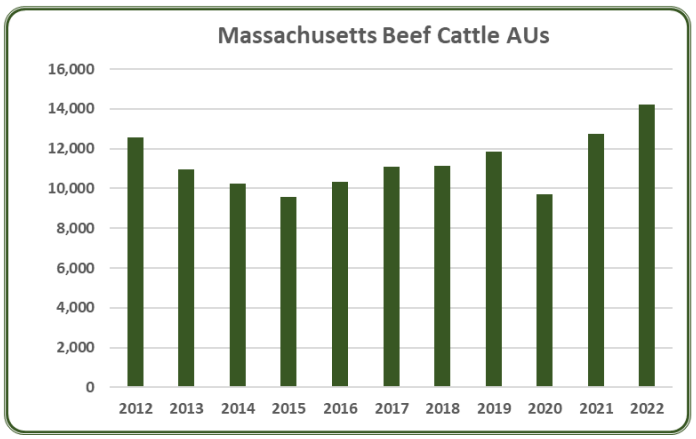
- From 2012 to 2022, dairy cattle AUs averaged 20.29 million. The herd was also relatively steady, fluctuating between 19.9-20.6 million AUs during that time. In 2022, dairy cattle AUs totaled 20.18 million, down 1.3% from 2021. Dairy cattle represented about 16% of all U.S. AUs.



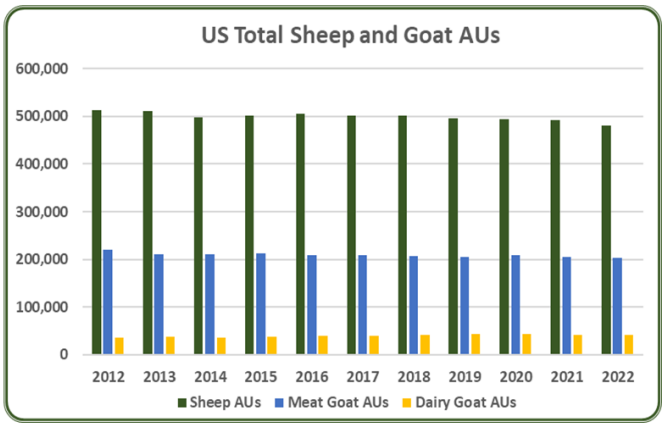
- In 2022, Massachusetts had 21,294 dairy cattle AUs, a 5.8% decrease from 2021. Dairy cattle accounted for 41.2% of the total AUs (51,643) in Massachusetts. From 2012 to 2022, the average number of dairy cattle AUs in Massachusetts was 25,300 AUs. Since 2012, dairy cattle AUs have decreased by 18.4%.



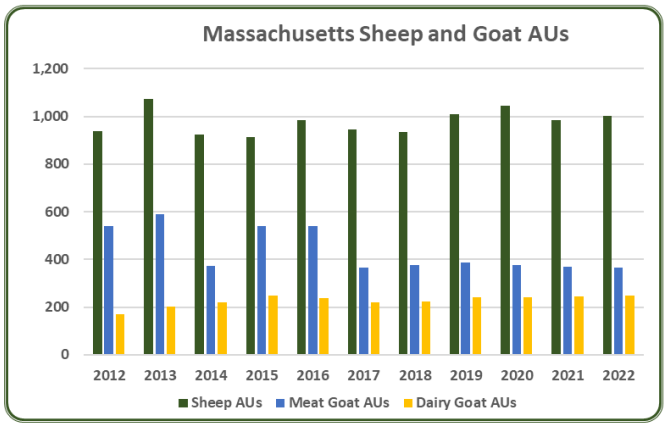
- From 2012 to 2022, beef cattle AUs averaged 63.9 million. In 2022 beef cattle AUs totaled 63.93 million, down 2% from last year, as beef cattle continued through a contraction phase in the cattle cycle which started in 2019. Beef AUs represent almost 50% of U.S. AUs, so changes in beef cattle AUs have large effects on total AUs.



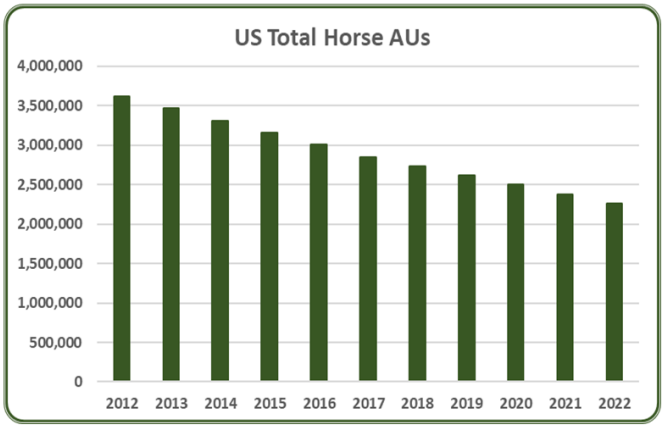
- In 2022, Massachusetts had 14,199 beef cattle AUs, an 11.5% increase from 2021. Beef cattle accounted for 27.5% of the total AUs (51,643) in Massachusetts. From 2012 to 2022, the average number of beef cattle AUs in Massachusetts was 11,306 AUs. Since 2012, beef cattle AUs have increased by 12.9%.



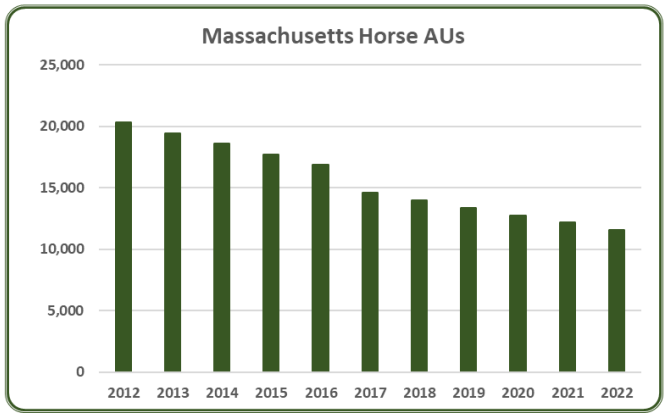
- Sheep, meat goats, and dairy goats account for less than 0.6% of U.S. total AUs. Over the past decade, sheep AUs averaged 500,000, meat goat AUs averaged 209,000 and dairy goat AUs averaged 40,000. Sheep and meat goat AUs have trended down while dairy goats trended up until 2019, then leveled off.



- In 2022, Massachusetts had a combined 1,616 sheep, meat goat, and dairy goat AUs, a 1% increase from 2021. These accounted for 3.1% of the total AUs (51,643) in Massachusetts. Individually, sheep AUs increased 1.9%, meat goat AUs decreased 1.6% and dairy goat AUs increased 1.5%. Combined there was a 2% decrease in sheep and goat AUs since 2012.



- Horses account for about 2% of U.S. total AUs. From 2012 to 2022, horse AUs averaged 2.90 million. However, a steady downtrend is present and 2022 horse AUs only totaled 2.26 million. U.S. horse AUs have decreased every year from 2012 to 2022, decreasing 37.6% over the entire period.



- In 2022, Massachusetts had 11,573 horse AUs, a 5% decrease from 2021. Horses accounted for 22.4% of the total AUs (51,643) in Massachusetts. From 2012 to 2022, the average number of horse AUs in Massachusetts was 15,590 AUs. Since 2012, horse AUs have decreased by 43.1%.

Massachusetts Additional Information and Methodology

Animal agriculture is an important part of Massachusetts's current and future economic health. To quantify the connection between animal agriculture and local economies, the United Soybean Board commissioned Decision Innovation Solutions, an economic research firm in Urbandale, Iowa, to conduct an in-depth analysis of several aspects of animal agriculture. This analysis includes the following components:

1. Economic impact of animal agriculture to local (state) economies during the 2012-2022 time period
2. SBM usage by animal species during the 2021/22 soybean marketing year
3. Animal Unit (AU) trends from 2012-2022

Given the long-term presence of animal agriculture in Massachusetts, of interest is the degree to which the industry impacts the Massachusetts economy. Estimates of output, jobs, earnings, taxes paid, and multipliers for Massachusetts animal agriculture are presented in this report. Methodology for this section of the report closely mirrors that followed in years' past. Also presented are estimates of the change in how animal agriculture has impacted Massachusetts's economy over the last decade. Differences, to the extent they are present, are noted within the larger national report which accompanies this state report.

As with any industry across the economic spectrum, there are ebbs and flows in activity that have implications for other parts of the economy. Again, using the same 2012-2022 time period as with the economic impact section of this state report, the "Animal Unit Trends" seeks to quantify production changes in animal agriculture in Massachusetts which have occurred. As shown in this state report, Massachusetts has seen changes within its animal agriculture industry. Expectations are that animal agriculture will continue to evolve over the next decade.

Animal agriculture is the single largest user of SBM in Massachusetts. Through in-depth conversations with many of the nation's top nutritionists and researchers, "bottom up" estimates of SBM usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of SBM used during the 2021-22 soybean marketing year for up to sixteen specific animal species has been estimated.

Should readers have comments or questions regarding methodology, results and interpretation, please contact the authors at info@decision-innovation.com or 515.639.2900.

Massachusetts Multipliers

Economic multipliers give a sense for how economic activity in a given industry is related to other industries in the same study area. To estimate the impact of animal agriculture on Massachusetts's economy, we applied RIMS II multipliers from the Department of Commerce, Bureau of Economic Analysis for cattle ranching and farming, dairy cattle and milk production, poultry and egg production, and other animal production (primarily hogs and pigs), where applicable.

Multipliers are generally stated in the form of "per million dollars" of output. As it relates to this analysis, multipliers are stated as the activity related to every million dollars of economic output in animal agriculture. Referring to the multipliers below, for every million dollars in output generated by the various segments of animal agriculture in Massachusetts, $1.41 to $1.74 million in total economic activity, $0.28 to $0.36 in household wages and 8 to 9 additional jobs are generated in the economy at large.

Appendix

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Animal Units (AUs)	Beef Cattle AUs	12,578	10,967	10,254	9,572	10,322	11,080	11,132	11,836	9,695	12,731	14,199
	Hog and Pig AUs	1,367	1,320	1,532	1,933	1,466	1,230	1,352	1,543	1,563	1,527	1,189
	Broiler AUs	335	334	332	341	343	323	323	323	357	343	354
	Turkey AUs	523	475	488	479	479	682	651	585	469	446	465
	Egg Layer AUs	747	760	771	848	966	977	1,007	977	939	934	952
	Dairy AUs	26,092	26,963	27,370	27,837	26,989	26,111	26,111	23,918	23,008	22,603	21,294
	Total Animal Units	**63,629**	**62,152**	**60,860**	**60,440**	**59,187**	**56,519**	**56,104**	**54,210**	**50,475**	**52,363**	**51,643**
Value of Production ($1,000)	Cattle and Calves ($1,000)	$ 10,692	$ 11,174	$ 12,449	$ 15,186	$ 9,225	$ 10,795	$ 8,223	$ 7,435	$ 7,600	$ 6,971	$ 7,003
	Hogs and Pigs ($1,000)	$ 1,526	$ 2,816	$ 2,199	$ 2,400	$ 1,920	$ 1,656	$ 1,832	$ 2,128	$ 1,904	$ 2,996	$ 2,680
	Broilers ($1,000)	$ 37,081	$ 45,183	$ 47,400	$ 41,352	$ 36,768	$ 43,174	$ 42,611	$ 37,177	$ 30,379	$ 42,730	$ 68,298
	Turkeys ($1,000)	$ 4,088	$ 4,293	$ 4,784	$ 5,063	$ 5,350	$ 5,589	$ 5,676	$ 5,968	$ 6,270	$ 6,584	$ 6,585
	Eggs ($1,000)	$ 2,583	$ 3,552	$ 3,585	$ 5,608	$ 1,425	$ 2,023	$ 3,194	$ 1,746	$ 1,934	$ 1,639	$ 7,221
	Milk ($1,000)	$ 43,800	$ 50,140	$ 60,813	$ 40,362	$ 38,233	$ 39,668	$ 35,148	$ 37,635	$ 36,600	$ 38,218	$ 50,572
	Other	$ 23,598	$ 24,910	$ 26,134	$ 27,414	$ 28,639	$ 29,756	$ 30,984	$ 32,234	$ 33,464	$ 34,691	$ 35,957
	Sheep and Lambs ($1,000)	$ 347	$ 429	$ 423	$ 472	$ 467	$ 354	$ 352	$ 372	$ 371	$ 368	$ 404
	Aquaculture ($1,000)	$ 23,251	$ 24,481	$ 25,711	$ 26,942	$ 28,172	$ 29,402	$ 30,632	$ 31,862	$ 33,093	$ 34,323	$ 35,553
	Total ($1,000)	**$ 123,368**	**$ 142,068**	**$ 157,364**	**$ 137,385**	**$ 121,559**	**$ 132,661**	**$ 127,668**	**$ 124,323**	**$ 118,151**	**$ 133,829**	**$ 178,316**

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Ag Census Data Category	Animal Type		2002	2007	2012	2017
Number of Farms by NAICS	Beef cattle ranching and farming (112111)		337	751	620	618
	Cattle feedlots (112112)		87	53	8	8
	Dairy cattle and milk production (11212)		279	258	147	140
	Hog and pig farming (1122)		72	82	135	119
	Poultry and egg production (1123)		163	480	380	265
	Sheep and goat farming (1124)		211	279	365	474
	Animal aquaculture and other animal production (1125,1129)		1,312	1,776	1,887	1,621
Value of Sales ($1,000)	Cattle and Calves		9,612	12,444	9,503	11,147
	Hogs and Pigs		withheld	2,108	2,898	2,098
	Poultry and Eggs		12,107	13,207	11,748	12,194
	Milk*				44,250	45,336
	Aquaculture		9,481	18,548	23,251	29,402
	Other (calculated)		76,044	28,546	6,046	11,484
		Total	107,244	125,338	97,696	111,661
Input Purchases	Livestock and poultry purchased	(Farms)	1,101	1,450	1,961	1,653
		$1,000	6,482	5,819	7,275	6,764
	Breeding livestock purchased	(Farms)	*373*	556	637	503
		$1,000	*2,703*	1,776	2,006	1,400
	Other livestock and poultry purchased	(Farms)	*816*	1,064	1,612	1,379
		$1,000	*3,779*	4,043	5,268	5,364
	Feed purchased	(Farms)	2,698	3,821	4,276	3,924
		$1,000	26,253	45,134	50,732	42,601

** Measurement of milk sales in 2002-2007 are not comparable to 2012-2017.*

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	Animal Type	Output ($1,000)	Earnings ($1,000)	Employment (Jobs)	Income Taxes Paid ($1,000)
2022 Animal Agriculture	Cattle and Calves	$ 10,219	$ 1,975	56	$ 498
	Hogs, Pigs, and Other	$ 54,568	$ 12,719	353	$ 3,205
	Poultry and Eggs	$ 138,961	$ 27,357	617	$ 6,894
	Dairy	$ 87,980	$ 18,090	475	$ 4,559
	Total	$ 291,727	$ 60,141	1,502	$ 15,155
Change from 2012 to 2022	Cattle and Calves	$ (9,957)	$ (1,924)	(55)	$ (485)
	Hogs, Pigs, and Other	$ 8,682	$ 2,024	56	$ 510
	Poultry and Eggs	$ 43,199	$ 8,505	192	$ 2,143
	Dairy	$ (10,560)	$ (2,171)	(57)	$ (547)
	Total	$ 31,363	$ 6,433	136	$ 1,621

	Animal Type	Output($)	Earnings ($)	Employment (Jobs)
RIMS II Multipliers	Cattle and Calves	$ 1.46	$ 0.28	8.0
	Hogs, Pigs, and Other	$ 1.41	$ 0.33	9.1
	Poultry and Eggs	$ 1.69	$ 0.33	7.5
	Dairy	$ 1.74	$ 0.36	9.4

Tax Rates	Federal effective income tax rate	14.0%
	Federal Social Security tax rate	6.2%
	State Effective Rate	5.0%
	Total	25.2%

Sources: 2002, 2007, 2012 and 2017 Census of Agriculture, USDA/NASS Survey Data, RIMS II Multipliers (U.S. Bureau of Economic Analysis), Tax-Rates.org & The Motley Fool.