North Carolina Economic Analysis of Animal Agriculture: 2011-2021

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Prepared For:

UNITED SOYBEAN BOARD™

Prepared By:

Decision Innovation Solutions

Contents

North Carolina Executive Summary

The use of soybean meal as a key feed ingredient is an important part of North Carolina 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 North Carolina. The success of North Carolina animal agriculture in turn has a large impact on the rest of the state and regional economies. For example, in the state of North Carolina during 2021 animal agriculture contributed:

- $24.1 billion in economic output
- 117,239 jobs
- $5.3 billion in earnings
- $1.3 billion in income taxes paid at local, state, and federal levels
- $157.4 million in the form of property taxes

North Carolina's animal agriculture consumed almost 3.0 million tons of soybean meal in 2021. This soybean meal was fed primarily to:

- Broilers (1.8 million tons)
- Hogs (492.4 thousand tons)
- Turkeys (426.3 thousand tons)

This report examines animal agriculture in North Carolina 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 North Carolina, 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 North Carolina and beyond.

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North Carolina Economic Impact of Animal Agriculture

Animal agriculture is an important part of North Carolina's economy. In 2021, North Carolina's animal agriculture contributed the following to the economy:

- About $24.1 billion in economic output
- $5.3 billion in household earnings
- 117,239 jobs
- $1.3 billion in income taxes

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

- Increased economic output by $3.9 billion
- Boosted household earnings by $825.7 million
- Added 16,849 jobs
- Paid $210.1 million more in income taxes

Below is a table which demonstrates this decade of change.

Measure		2021		Change 2011-2021	% Change 2011-2021
Output ($1,000)	$	24,104,016	$	3,884,907	19.21%
Earnings ($1,000)	$	5,303,280	$	825,678	18.44%
Employment (Jobs)		117,239		16,849	16.78%
Income Taxes Paid ($1,000)	$	1,349,685	$	210,135	18.44%
Property Taxes Paid in 2017 ($1,000)	$	157,354			

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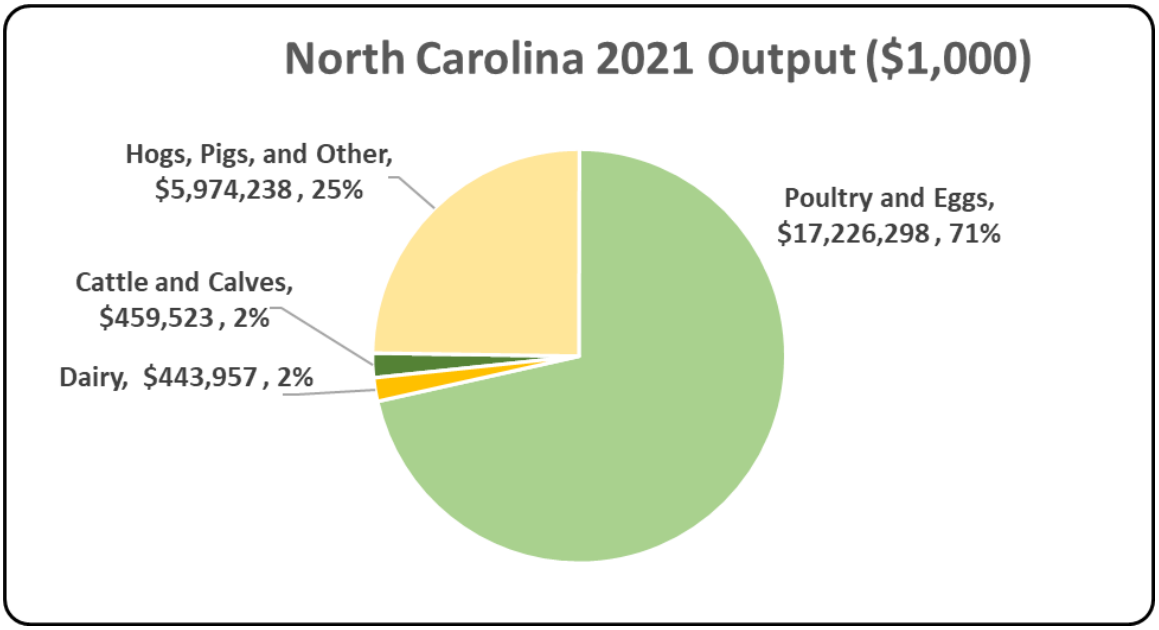
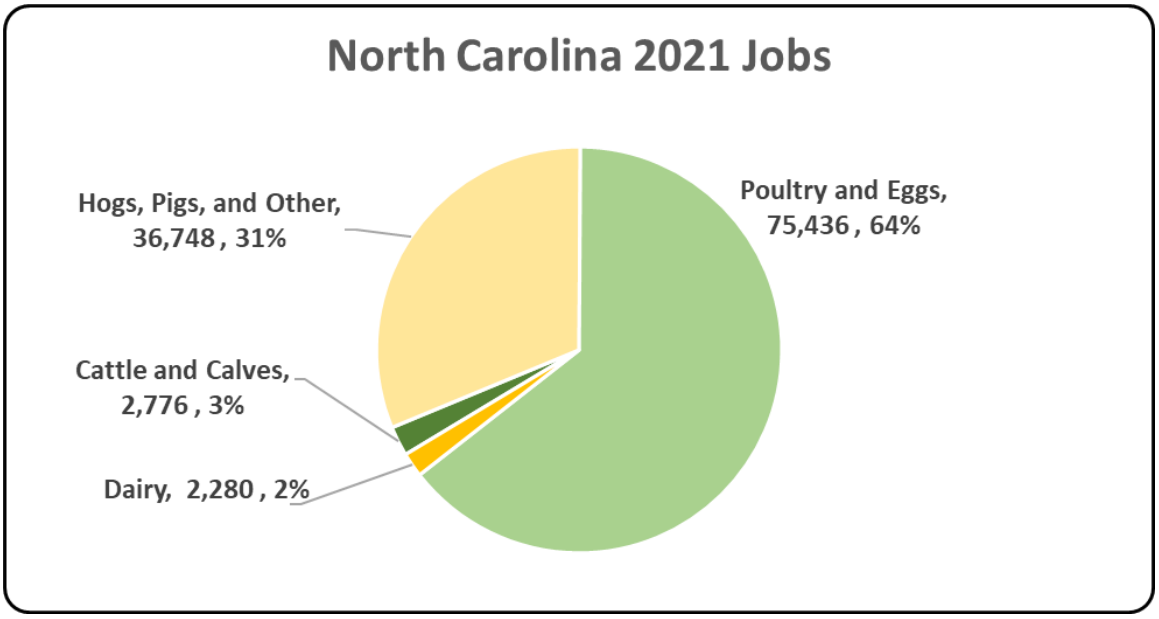
North Carolina Output

"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 North Carolina economy. Animal agriculture's impact on North Carolina total economic output is about $24.1 billion.



North Carolina 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 North Carolina in terms of animal agriculture jobs. As shown, animal agriculture contributes significantly to North Carolina total jobs, contributing 117,239 jobs within and outside of animal agriculture.



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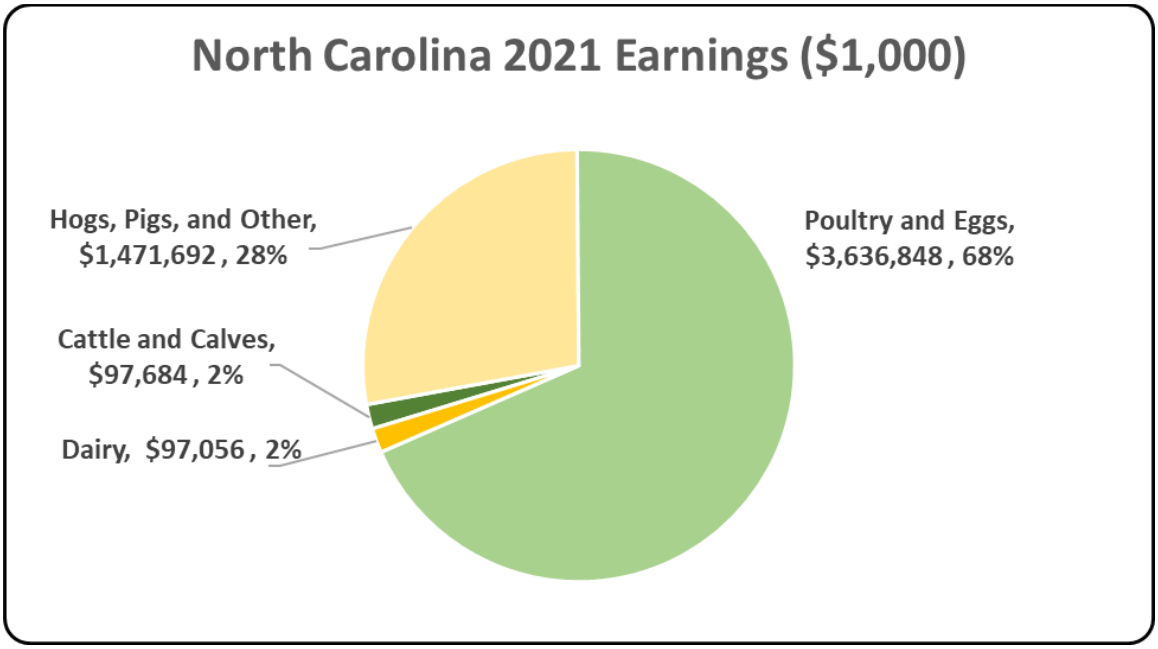
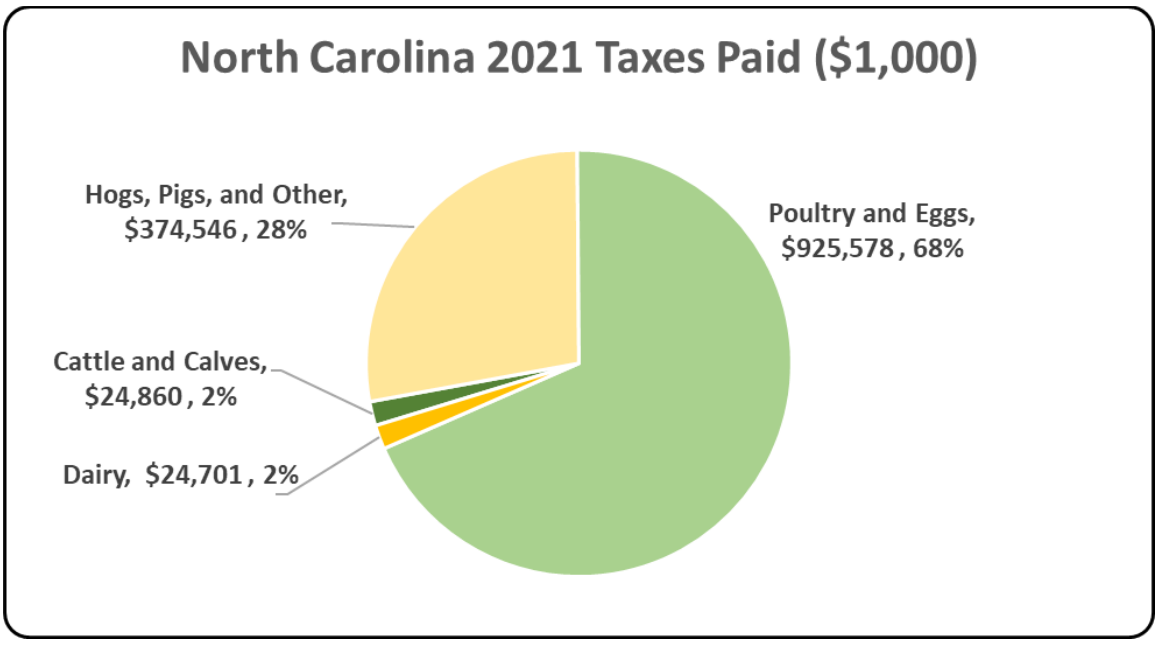
North Carolina Earnings

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 North Carolina economy in terms of earnings. North Carolina's animal agriculture contributed about $5.3 billion to household earnings in 2021.



North Carolina Taxes Paid by Animal Agriculture

North Carolina's animal agriculture is also a significant source of tax revenue. In 2021, the state's animal agriculture industry paid about $1.3 billion in income taxes at local, state, and federal levels. Plus, the 2017 Census of Agriculture estimated $157.4 million in property taxes paid by all of North Carolina agriculture during 2017. Estimates of income taxes paid by animal agriculture are shown in the following chart.



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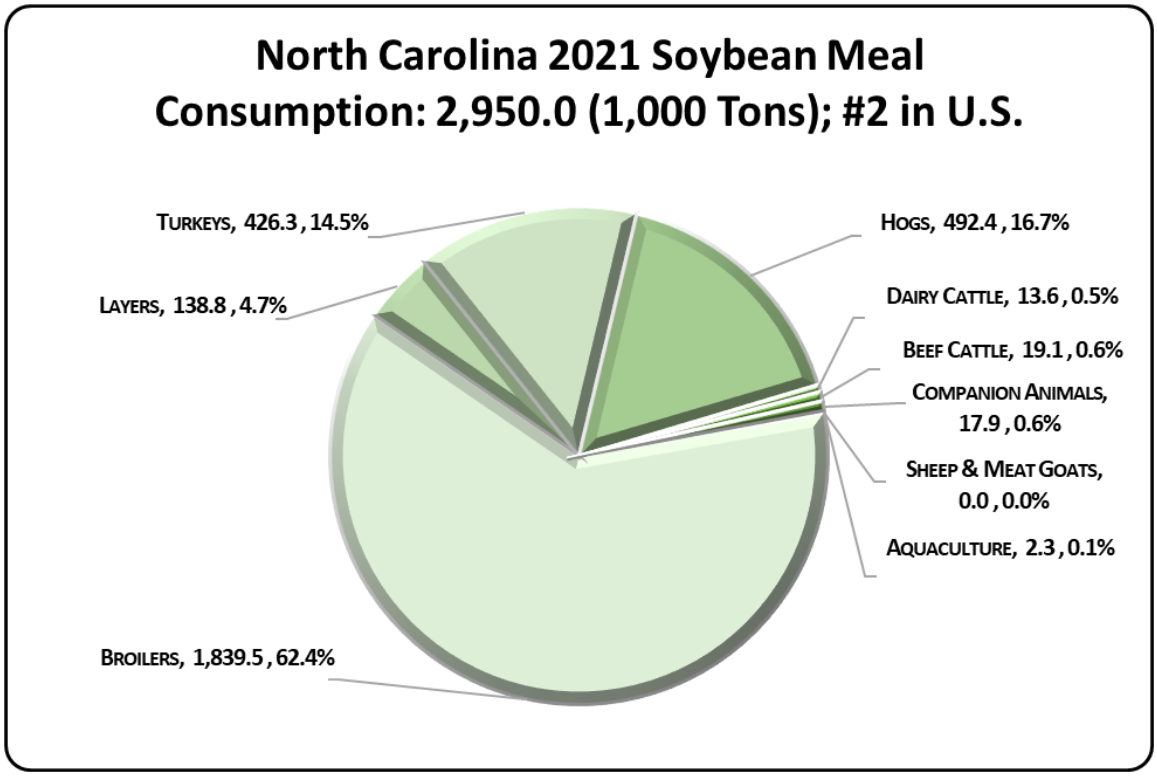
North Carolina Animal Agriculture Soybean Meal Consumption

The choice to use soybean meal 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 soybean meal (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 soybean meal usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of soybean meal used during the 2020-21 soybean marketing year by up to sixteen specific animal species has been estimated.

North Carolina's animal agriculture consumed almost 3.0 million tons of soybean meal in 2021, placing the state as number 2 in the nation in terms of soybean meal consumption (see figure below). Additionally, animal agriculture in North Carolina consumed 223.9 thousand tons in soy hulls. The three segments of animal agriculture that led the state in estimated soybean meal consumption are:

1. Broilers (1.8 million tons)
2. Hogs (492.4 thousand tons)
3. Turkeys (426.3 thousand tons)

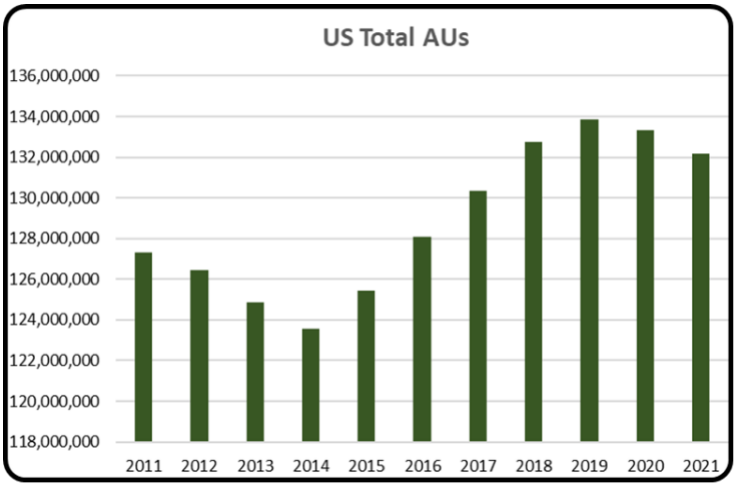


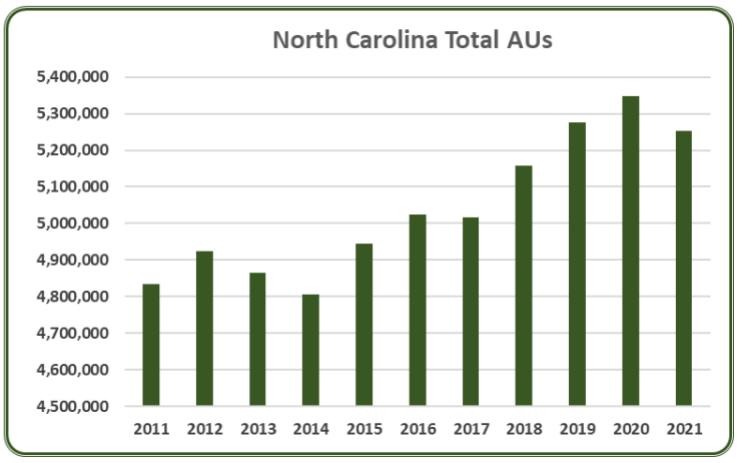
North Carolina Animal Unit (AU) Trends

Over time, prices of feed, meat, eggs and milk, as well as levels of demand for these products in the United States and abroad have an impact on the size of animal agriculture in the state of North Carolina. Due to this reality, using a single year as a measure of the presence and strength of a sector 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 North Carolina and to give perspective on North Carolina's contribution to the nation's animal agriculture industry and beyond.

Similar to 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.

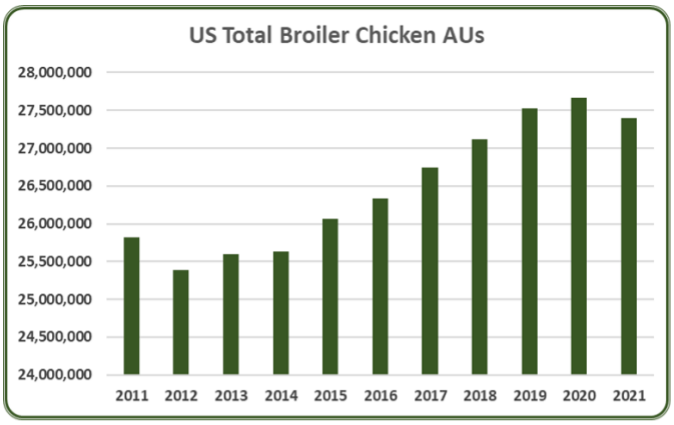
As shown in the accompanying charts and written commentary, certain components of animal agriculture are more present, and therefore more dominant than others. This is due primarily to geography (i.e., weather patterns and access to certain transportation hubs), proximity to high quality, relevant feed ingredients, and the local animal agriculture regulatory framework. In North Carolina, the largest three segments of animal agriculture in terms of AUs during 2021 were: Broilers (2.91 million AUs), Hogs (1.10 million AUs), and Beef Cattle (609,617 AUs). Total animal units in North Carolina during 2021 were 5.25 million AUs.



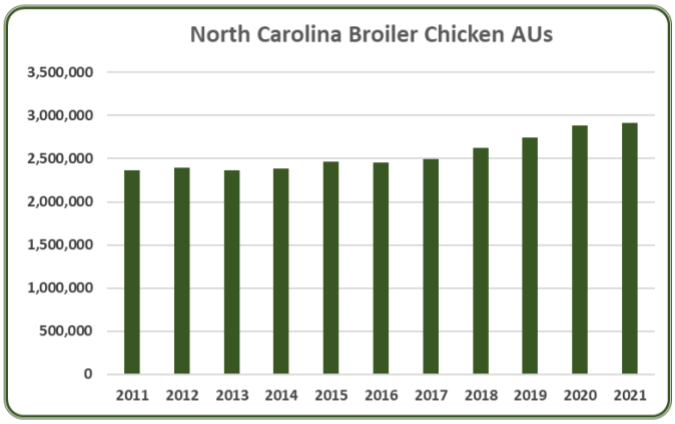


- In 2021, total AUs in the U.S. decreased by 0.87% to 132 million. Eight out of the ten commodities followed saw a decrease, with four seeing a decrease of over 100,000 AUs. Total AUs were lowest in 2013 and 2014 and peaked in 2019. There has been a downward trend in total AUs since 2019.

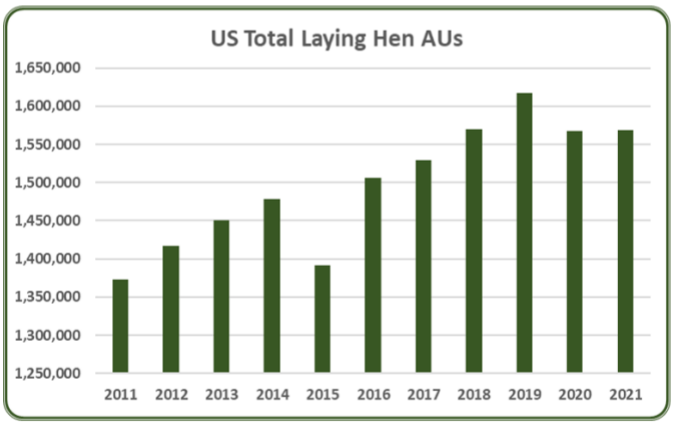
- In 2021, North Carolina had 5.25 million total AUs, a 1.77% decrease from 2020. This was primarily due to a decrease in hog AUs. From 2011 to 2021, the average number of total AUs in North Carolina was 5.04 million AUs. Since 2011, total AUs in North Carolina have increased by 8.66%.



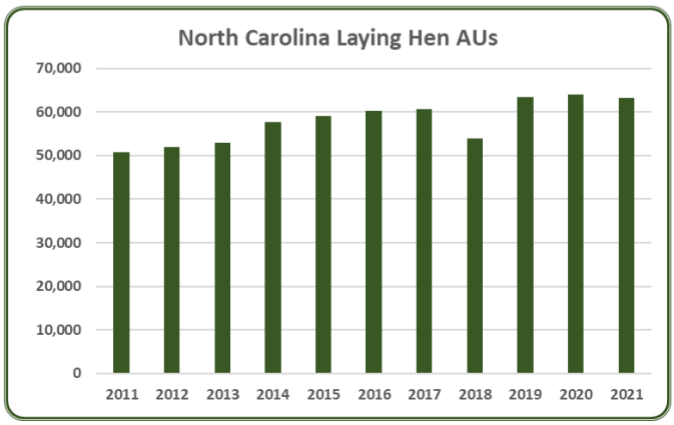
- U.S. broiler production is concentrated in the southern states – Georgia being the largest producer. On average, from 2011 to 2021, broiler chicken AUs were 26.5 million across the U.S. From 2020 and 2021 there was a 0.99% decrease (274,200) in broiler chicken AUs –Alabama, Delaware, and Maryland, were the largest contributors to this decrease.



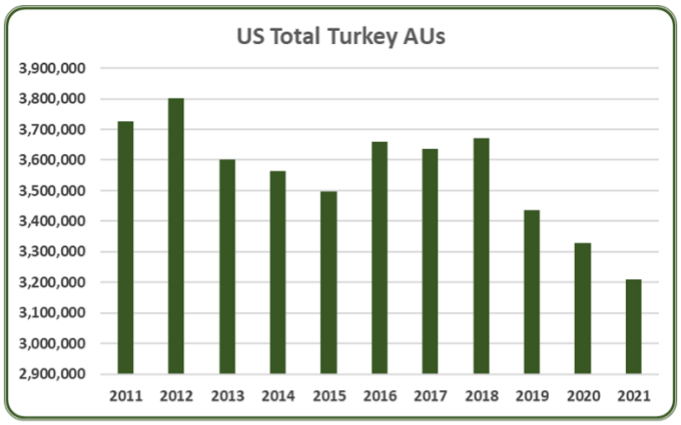
- In 2021, North Carolina had 2.91 million broiler AUs, a 1.05% increase from 2020. Broilers accounted for 55.47% of the total AUs (5.25 million) in North Carolina, making it the largest animal sector in the state. From 2011 to 2021, the average number of broiler AUs in North Carolina was 2.5 million. Since 2011, broiler AUs have increased by 23.45%.



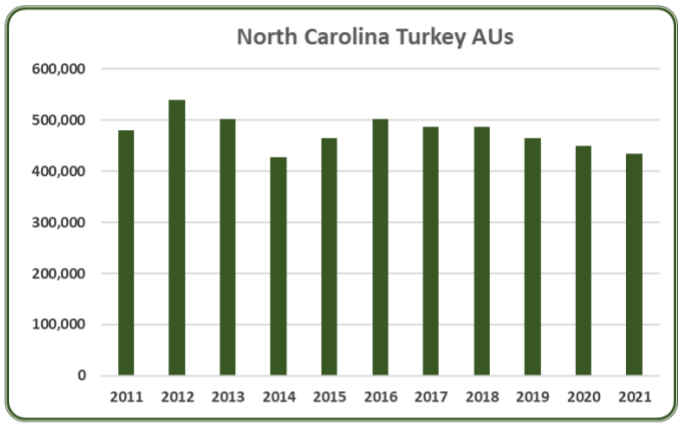
- From 2011 to 2021, U.S. layer AUs averaged 1.5 million. In 2021, layer AUs were 1.57 million, a 1.19% increase from the year before. Despite nationwide increase, 38 states experienced a decrease in layer AUs compared to last year.



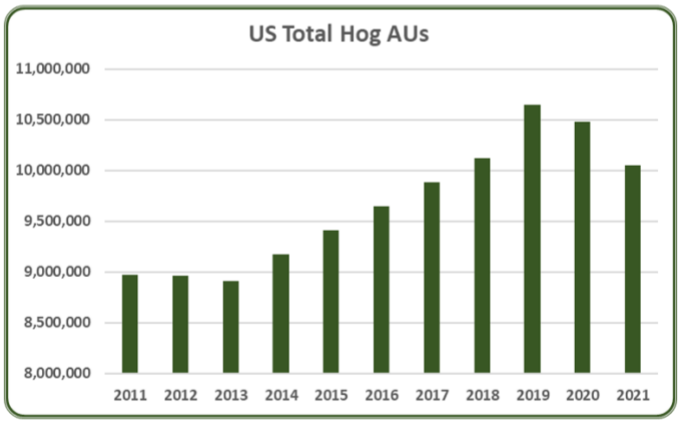
- In 2021, North Carolina had 63,212 layer AUs, a 1.18% decrease from 2020. Layers accounted for 1.2% of the total AUs (5.25 million) in North Carolina. From 2011 to 2021, the average number of layer AUs in North Carolina was 57,978. Since 2011, layer AUs have increased by 24.37%.



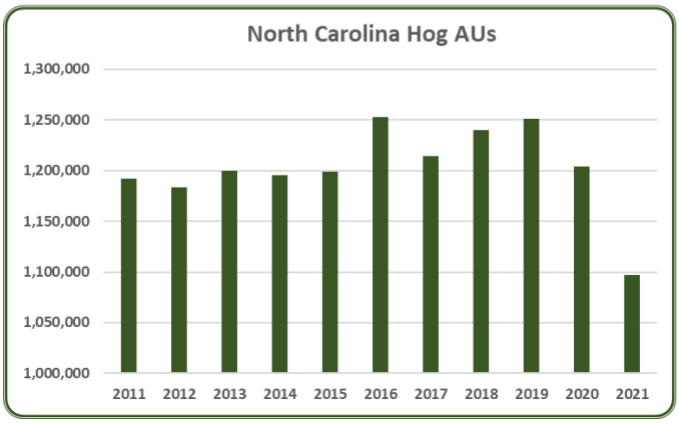
- In 2021, turkey AUs were at 3.2 million, a 3.60% drop from the previous year. Minnesota had the most turkey AUs during 2021 with 18.93% of the total U.S. turkey AUs. Although growth occurred immediately following the 2015 avian influenza outbreak, 2021 AUs reached a decade low – 47 states experienced a decrease in turkey AUs.



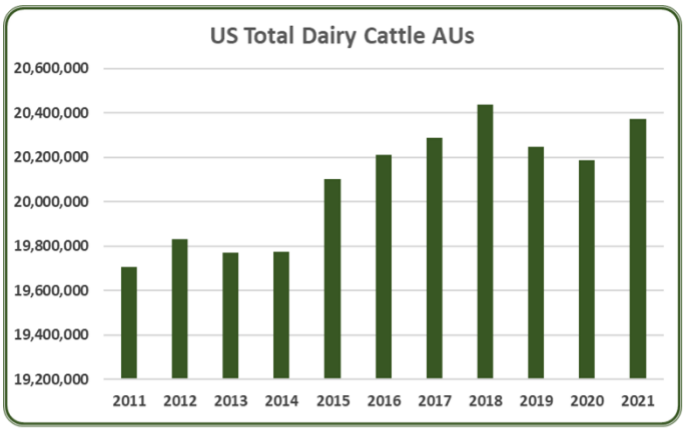
- In 2021, North Carolina had 435,000 turkey AUs, a 3.33% decrease from 2020. Turkeys accounted for 8.28% of the total AUs (5.25 million) in North Carolina. From 2011 to 2021, the average number of turkey AUs in North Carolina was 476,591. Since 2011, turkey AUs have decreased by 9.38%.



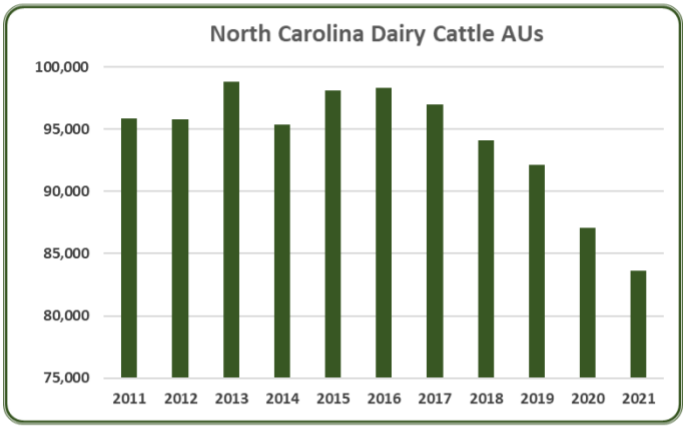
- In 2021, hog AUs were at 10.05 million, a 4.09% drop from the previous year. From 2011 to 2021, hog AUs averaged 9.66 million. During this period hog AUs increased 12.06% (1.08 million AUs). Hogs make up 7.60% of all AUs within the United States.



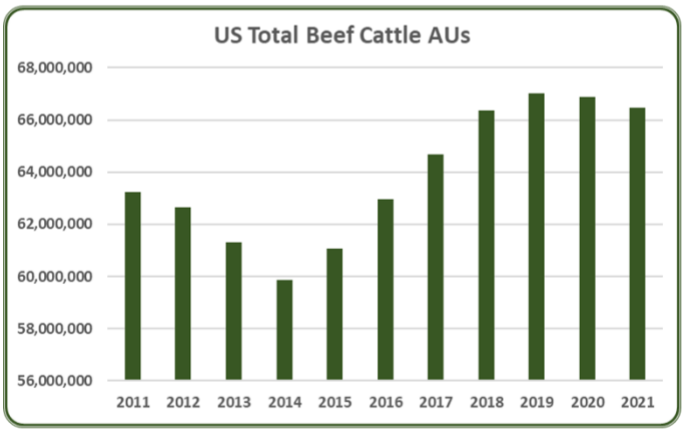
- In 2021, North Carolina had 1.10 million hog AUs, a 8.89% decrease from 2020. Hogs accounted for 20.88% of the total AUs (5.25 million) in North Carolina, making it the second largest animal sector in the state. From 2011 to 2021, the average number of hog AUs in North Carolina was 1.20 million. Since 2011, hog AUs have decreased by 7.98%.



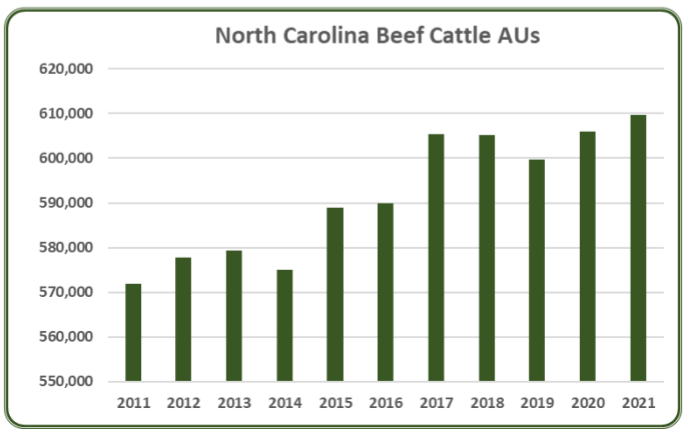
- From 2011 to 2021, dairy cattle AUs averaged 20.1 million. In 2021, dairy cattle AUs increased by 0.93% (187,902 AUs) from 2020 – 26 states experienced a decrease in dairy cattle AUs. California, Wisconsin, and Idaho have, respectively, the highest number of dairy cattle AUs.



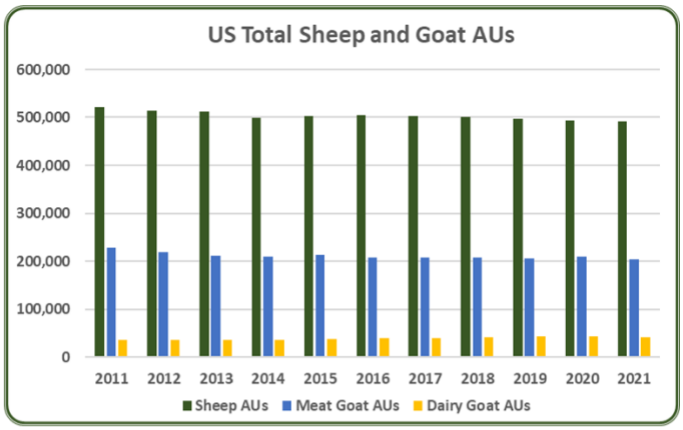
- In 2021, North Carolina had 83,626 dairy cattle AUs, a 3.96% decrease from 2020. Dairy cattle accounted for 1.59% of the total AUs (5.25 million) in North Carolina. From 2011 to 2021, the average number of dairy cattle AUs in North Carolina was 94,198. Since 2011, dairy cattle AUs have decreased by 12.74%.



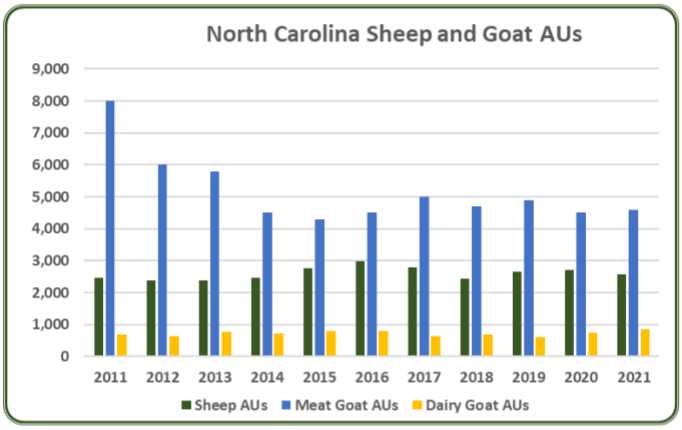
- From 2011 to 2021, beef cattle AUs averaged 63.9 million. Over the past decade beef cattle AUs have increased by 5.13%, but have decreased by 0.60% (402,745 AUs) from last year. Beef AUs have trended upward after a drought occurred in the middle of the ten-year period, still up 11.02% since the recent low in 2014.



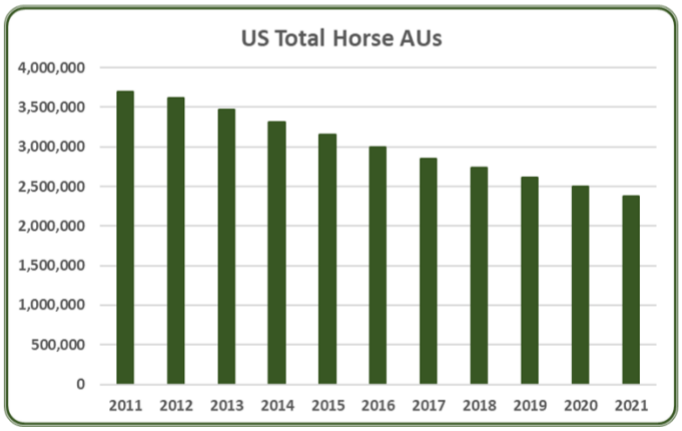
- In 2021, North Carolina had 609,617 beef cattle AUs, a 0.6% increase from 2020. Beef cattle accounted for 11.6% of the total AUs (5.25 million) in North Carolina. From 2011 to 2021, the average number of beef cattle AUs in North Carolina was 591,683. Since 2011, beef cattle AUs have increased by 6.6%.



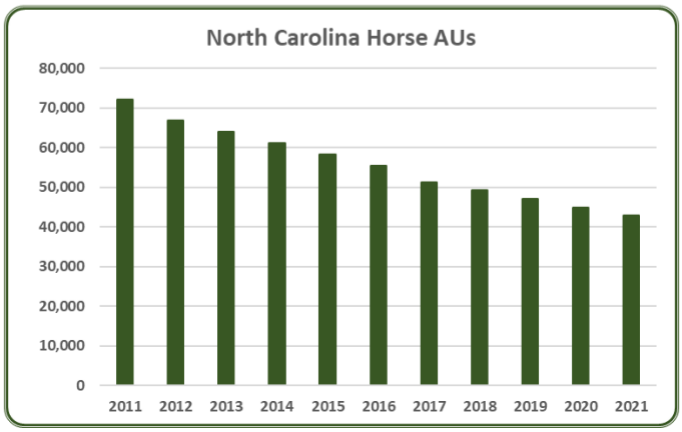
- Sheep, meat goats, and dairy goats account for less than 0.56% of U.S. total AUs. Individually, dairy goat AUs increased by 16.67% over the past decade; sheep AUs and meat goat AUs decreased by 5.53% and 10.23%. Combined, there was a 5.88% decrease in AUs – from 784,600 in 2011 to 738,500 in 2021.



- In 2021, North Carolina had a combined 8,015 sheep, meat goat, and dairy goat AUs, a 0.63% increase from 2020. These account for 0.15% of the total AUs (5.25 million) in North Carolina. Individually, sheep and dairy goat AUs increased 3.64% and 21.43% respectively while meat goat AUs decreased 42.50% since 2011. Combined there was a 28.28% decrease since 2011.



- Horses account for about 1.80% of U.S total AUs. From 2011 to 2021, horse AUs show a downward trend – from 3.70 million in 2011 to 2.38 million in 2021; a 35.79% decrease. In 2021, all 50 states experienced a decrease in horse AUs.



- In 2021, North Carolina had 42,822 horse AUs, a 4.73% decrease from 2020. Horses accounted for 0.82% of the total AUs (5.25 million) in North Carolina. From 2011 to 2021, the average number of horse AUs in North Carolina was 55,739. Since 2011, horse AUs have decreased by 40.55%.

North Carolina Additional Information and Methodology

Animal agriculture is an important part of North Carolina'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 2011-2021 time period
2. Soybean meal usage by animal species during the 2020-21 soybean marketing year
3. Animal Unit (AU) trends from 2011-2021

Given the long-term presence of animal agriculture in North Carolina, of interest is the degree to which the industry impacts the North Carolina economy. Estimates of output, jobs, earnings, taxes paid, and multipliers for North Carolina 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 North Carolina'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 2011-2021 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 North Carolina which have occurred. As shown in this state report, North Carolina 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 soybean meal in North Carolina. Through in-depth conversations with many of the nation's top nutritionists and researchers, "bottom up" estimates of soybean meal usage by animal type were determined. Using the input from these conversations and additional analysis performed by Decision Innovation Solutions, the quantity of soybean meal used during the 2020-21 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.

North Carolina 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 North Carolina'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 North Carolina, $1.87 to $3.00 million in total economic activity, $0.40 to $0.63 in household wages and 11 to 13 additional jobs are generated in the economy at large.

Appendix

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Animal Units (AUs)	Beef Cattle AUs	571,855	577,697	579,326	574,945	588,904	589,945	605,375	605,241	599,625	605,987	609,617
	Hog and Pig AUs	1,192,159	1,183,134	1,199,955	1,195,228	1,199,213	1,252,905	1,214,207	1,240,184	1,251,469	1,204,091	1,096,995
	Broiler AUs	2,360,700	2,398,800	2,359,800	2,385,600	2,468,100	2,456,100	2,492,400	2,620,800	2,748,300	2,883,900	2,914,200
	Turkey AUs	480,000	540,000	502,500	427,500	465,000	502,500	487,500	487,500	465,000	450,000	435,000
	Egg Layer AUs	50,824	51,944	52,968	57,612	59,128	60,248	60,532	53,868	63,456	63,968	63,212
	Dairy AUs	95,840	95,770	98,815	95,382	98,101	98,331	96,964	94,142	92,132	87,073	83,626
	Total Animal Units	**4,834,589**	**4,923,219**	**4,866,321**	**4,805,095**	**4,944,605**	**5,023,754**	**5,016,692**	**5,158,786**	**5,275,219**	**5,347,934**	**5,253,487**
Value of Production ($1,000)	Cattle and Calves ($1,000)	$ 306,298	$ 316,790	$ 304,014	$ 412,922	$ 404,242	$ 272,237	$ 283,501	$ 247,350	$ 226,824	$ 229,681	$ 245,498
	Hogs and Pigs ($1,000)	$ 2,471,953	$ 2,553,214	$ 2,824,115	$ 2,821,777	$ 2,209,833	$ 2,067,317	$ 2,269,339	$ 2,078,354	$ 2,100,521	$ 1,839,738	$ 3,085,513
	Broilers ($1,000)	$ 2,564,433	$ 2,838,600	$ 3,580,997	$ 3,849,710	$ 3,452,400	$ 3,091,561	$ 3,570,435	$ 3,857,883	$ 3,606,314	$ 2,822,007	$ 4,289,303
	Turkeys ($1,000)	$ 675,729	$ 826,506	$ 717,835	$ 728,993	$ 879,794	$ 989,027	$ 730,463	$ 583,279	$ 647,896	$ 775,873	$ 930,650
	Eggs ($1,000)	$ 375,573	$ 392,549	$ 431,075	$ 500,526	$ 588,368	$ 444,441	$ 461,195	$ 509,017	$ 443,693	$ 504,920	$ 512,783
	Milk ($1,000)	$ 207,016	$ 192,700	$ 200,090	$ 246,977	$ 183,210	$ 165,015	$ 178,976	$ 162,101	$ 174,086	$ 168,260	$ 176,981
	Other	$ 24,728	$ 24,550	$ 26,067	$ 27,656	$ 29,449	$ 30,971	$ 32,437	$ 33,771	$ 35,385	$ 36,973	$ 38,435
	Sheep and Lambs ($1,000)	$ 1,169	$ 1,185	$ 1,185	$ 1,258	$ 1,535	$ 1,540	$ 1,489	$ 1,306	$ 1,404	$ 1,475	$ 1,421
	Aquaculture ($1,000)	$ 23,559	$ 23,365	$ 24,882	$ 26,398	$ 27,915	$ 29,431	$ 30,948	$ 32,465	$ 33,981	$ 35,498	$ 37,014
	Total ($1,000)	**$ 6,625,730**	**$ 7,144,909**	**$ 8,084,193**	**$ 8,588,561**	**$ 7,747,296**	**$ 7,060,569**	**$ 7,526,347**	**$ 7,471,755**	**$ 7,234,719**	**$ 6,377,452**	**$ 9,279,163**

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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)		16,761	14,413	13,909	13,583
	Cattle feedlots (112112)		13	3	10	18
	Dairy cattle and milk production (11212)		740	381	263	261
	Hog and pig farming (1122)		1,735	1,619	1,170	1,264
	Poultry and egg production (1123)		3,827	4,096	3,404	3,106
	Sheep and goat farming (1124)		1,004	2,437	1,922	2,046
	Animal aquaculture and other animal production (1125,1129)		5,232	6,290	5,190	4,943
Value of Sales ($1,000)	Cattle and Calves		185,222	288,801	332,733	275,175
	Hogs and Pigs		2,183,646	3,104,731	2,873,988	3,216,902
	Poultry and Eggs		2,382,365	4,087,004	4,837,026	5,413,591
	Milk*				179,265	184,855
	Aquaculture		17,669	32,175	23,365	30,948
	Other (calculated)		33,744	33,266	15,340	44,223
		Total	4,953,052	7,707,350	8,261,717	9,165,694
Input Purchases	Livestock and poultry purchased	(Farms)	11,972	12,342	12,827	12,188
		$1,000	1,049,514	1,666,076	1,397,510	1,674,565
	Breeding livestock purchased	(Farms)	*5,119*	5,004	5,806	5,789
		$1,000	*57,036*	131,277	136,342	193,167
	Other livestock and poultry purchased	(Farms)	*7,997*	8,677	8,692	8,015
		$1,000	*992,478*	1,534,800	1,261,168	1,481,398
	Feed purchased	(Farms)	30,938	28,263	29,837	29,230
		$1,000	1,917,997	3,183,993	4,121,552	3,124,286

** 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)
2021 Animal Agriculture	Cattle and Calves	$ 459,523	$ 97,684	2,776	$ 24,860
	Hogs, Pigs, and Other	$ 5,974,238	$ 1,471,692	36,748	$ 374,546
	Poultry and Eggs	$ 17,226,298	$ 3,636,848	75,436	$ 925,578
	Dairy	$ 443,957	$ 97,056	2,280	$ 24,701
	Total	$ 24,104,016	$ 5,303,280	117,239	$ 1,349,685
Change from 2011 to 2021	Cattle and Calves	$ (233,284)	$ (49,591)	(1,409)	$ (12,621)
	Hogs, Pigs, and Other	$ 204,572	$ 50,394	1,258	$ 12,825
	Poultry and Eggs	$ 4,097,182	$ 865,005	17,942	$ 220,144
	Dairy	$ (183,562)	$ (40,130)	(943)	$ (10,213)
	Total	$ 3,884,907	$ 825,678	16,849	$ 210,135

	Animal Type	Output($)	Earnings ($)	Employment (Jobs)
RIMS II Multipliers	Cattle and Calves	$ 1.87	$ 0.40	11.3
	Hogs, Pigs, and Other	$ 1.91	$ 0.47	11.8
	Poultry and Eggs	$ 3.00	$ 0.63	13.2
	Dairy	$ 2.51	$ 0.55	12.9

Tax Rates	Federal effective income tax rate	14.0%
	Federal Social Security tax rate	6.2%
	State Effective Rate	5.3%
	Total	25.5%

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.

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