

Economic Analysis of Animal Agriculture 2004-2014

NORTH DAKOTA

**A Report for
United Soybean Board**



September 2015



Bridging Your Research Needs.

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North Dakota Executive Summary

The use of soybean meal as a key feed ingredient is a modest part of North Dakota's animal agriculture. While the degree to which animal agriculture utilizes this versatile feed ingredient has fluctuated with time, it remains a factor in animal agriculture's success in North Dakota. The success of North Dakota animal agriculture in turn has a large impact on the rest of the state and regional economies. For example, in the state of North Dakota during 2014 animal agriculture contributed:

- \$3.5 billion in economic output
- 14,139 jobs
- \$550.0 million in earnings
- \$127.3 million in income taxes paid at local, state, and federal levels
- \$129.9 million in the form of property taxes

Plus, from 2004-2014 animal agriculture in North Dakota increased economic output by over \$596.4 million, boosted household earnings by \$94.0 million, contributed 2,404 additional jobs and paid \$21.8 million in additional tax revenues.

North Dakota's animal agriculture consumed about 97.1 thousand tons of soybean meal in 2014. This soybean meal was fed primarily to:

- Beef Cows (53.8 thousand tons)
- Hogs (34.5 thousand tons)
- Dairy Cows (3.2 thousand tons)

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

North Dakota Economic Impact of Animal Agriculture

Animal agriculture is an integral part of North Dakota's economy. In 2014, North Dakota's animal agriculture contributed the following to the economy:

- About \$3.5 billion in economic output
- \$550.0 million in household earnings
- 14,139 jobs
- \$127.3 million in income taxes

And the animal agriculture sector has shown substantial growth during challenging economic times. During the last decade North Dakota's animal agriculture has:

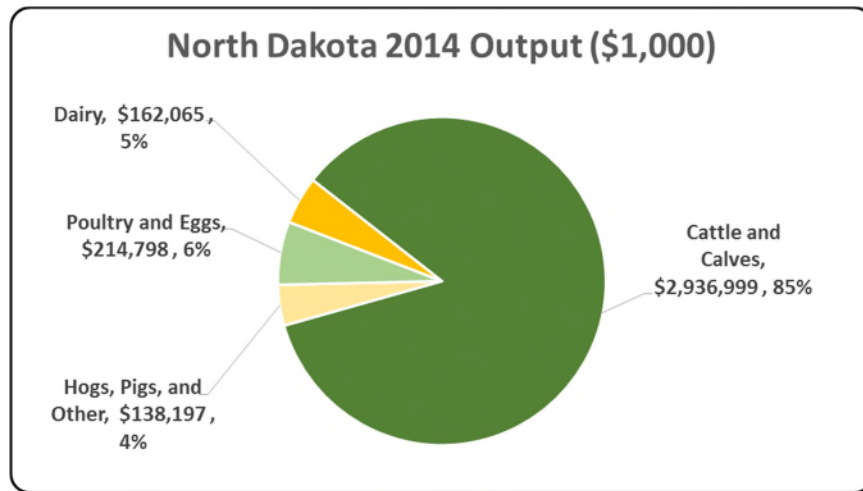
- Increased economic output by \$596.4 million
- Boosted household earnings by \$94.0 million
- Added 2,404 jobs
- Paid an additional \$21.8 million in income taxes

Below is a table which demonstrates this decade of change.

Measure	2014	Change 2004-2014	% Change 2004-2014
Output (\$1,000)	\$ 3,452,060	\$ 596,415	20.89%
Earnings (\$1,000)	\$ 549,985	\$ 94,022	20.62%
Employment (Jobs)	14,139	2,404	20.48%
Income Taxes Paid (\$1,000)	\$ 127,322	\$ 21,766	20.62%
Property Taxes Paid in 2012 (\$1,000)	\$ 129,909		

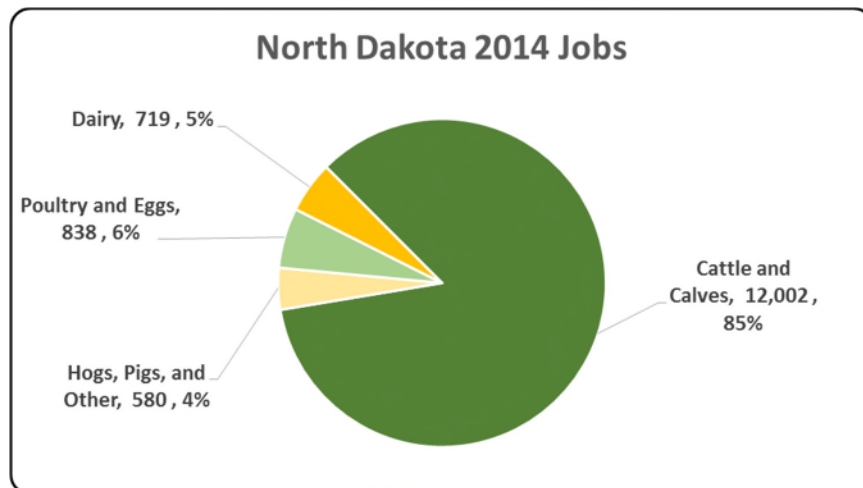
North Dakota Output

“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 chart illustrates the impact of animal agriculture to the North Dakota economy. Animal agriculture’s impact on North Dakota total economic output is about \$3.5 billion.



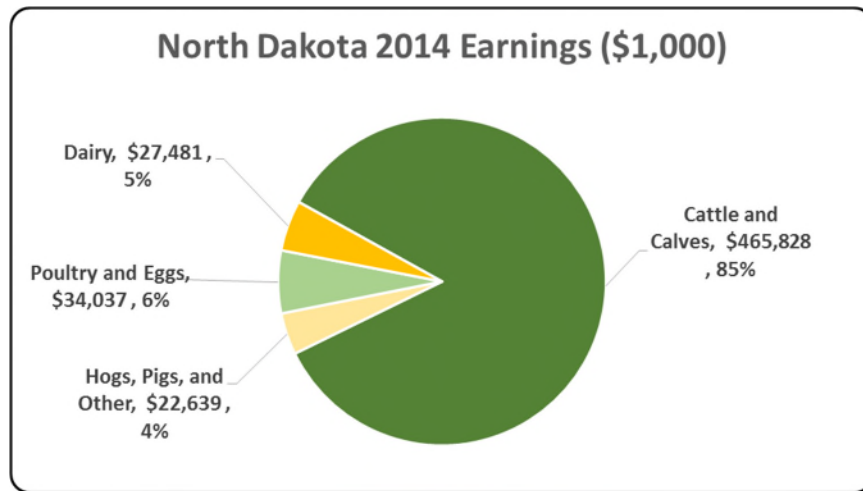
North Dakota Jobs

“Jobs” represents an estimate of the number of full or part-time positions (jobs) currently filled in an area and/or industry. The chart illustrates the contribution to North Dakota in terms of animal agriculture jobs. As shown, animal agriculture contributes significantly to North Dakota total jobs, contributing 14,139 jobs within and outside of animal agriculture.



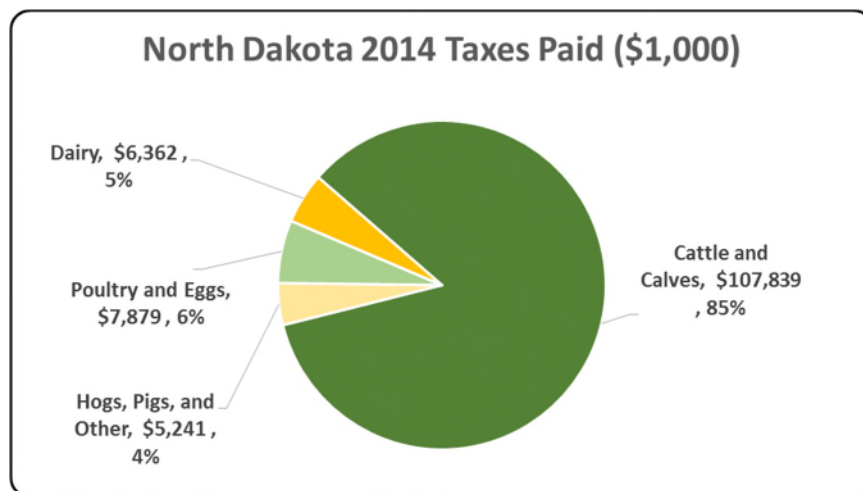
North Dakota Earnings

Earnings includes wages and salaries plus proprietors' income, which is the net earnings of sole-proprietors and partnerships. The chart illustrates the impact of animal agriculture to the North Dakota economy in terms of earnings. North Dakota's animal agriculture contributed about \$550.0 million to household earnings in 2014.



North Dakota Taxes Paid by Animal Agriculture

North Dakota's animal agriculture is also a significant source of tax revenue. In 2014, the state's animal agriculture industry paid about \$127.3 million in income taxes at local, state, and federal levels. Plus the 2012 Census of Agriculture estimated \$129.9 million in property taxes paid by all of North Dakota agriculture during 2012. Estimates of income taxes paid by animal agriculture are shown in the following chart.



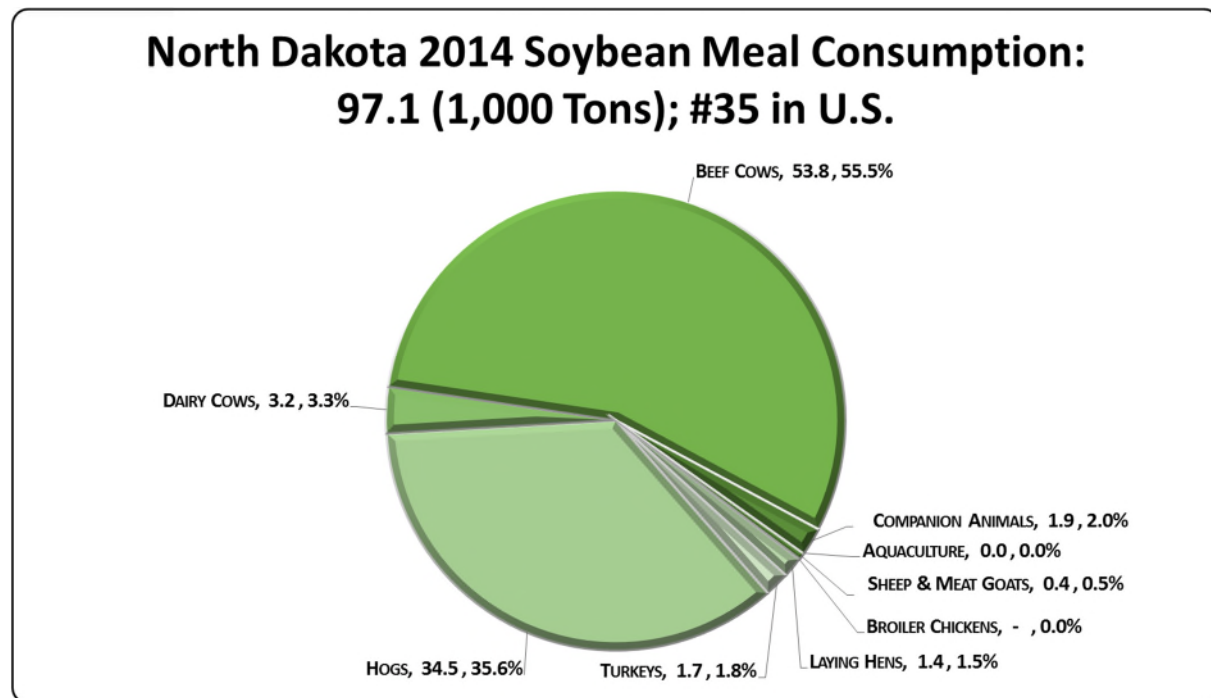
North Dakota Animal Agriculture Soybean Meal Consumption

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 2013-14 soybean marketing year by up to sixteen specific animal species has been estimated.

North Dakota’s animal agriculture consumed almost 97.1 thousand tons of soybean meal in 2014, placing the state as #35 in the nation in terms of soybean meal consumption (see figure below). The three segments of animal agriculture that led the state in estimated soybean meal consumption are:

- Beef Cows (53.8 thousand tons)
- Hogs (34.5 thousand tons)
- Dairy Cows (3.2 thousand tons)

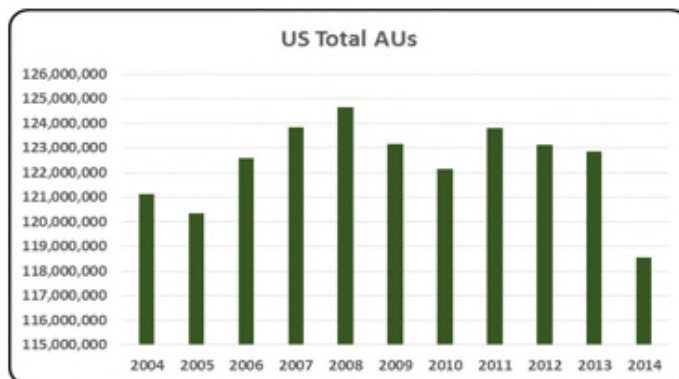


North Dakota Animal Unit (AU) Trends

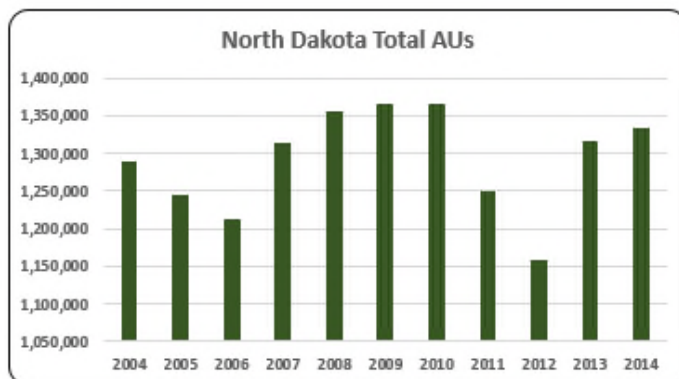
Over time, prices of feed, meat, eggs and milk, as well as levels of demand for these products in the United States and abroad have an impact on the size of animal agriculture in the State of North Dakota. Due to this reality, using a single year as a measure of the presence and strength of a sector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

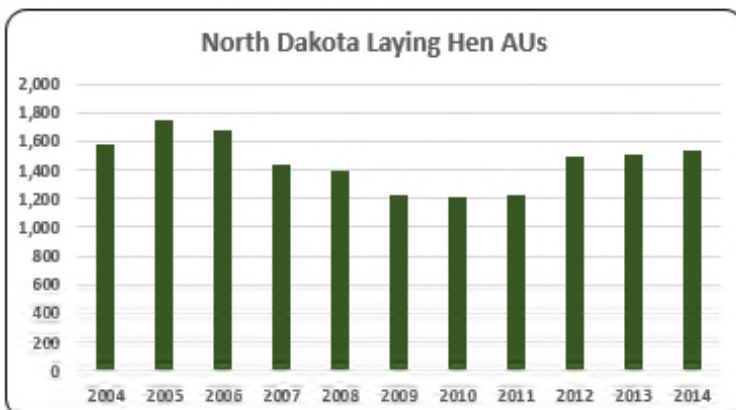
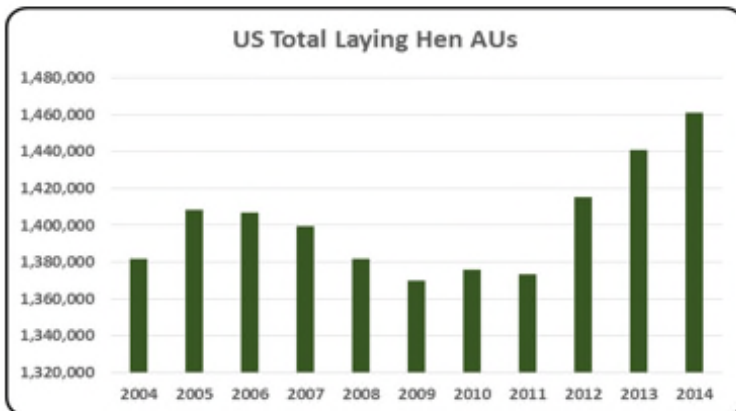
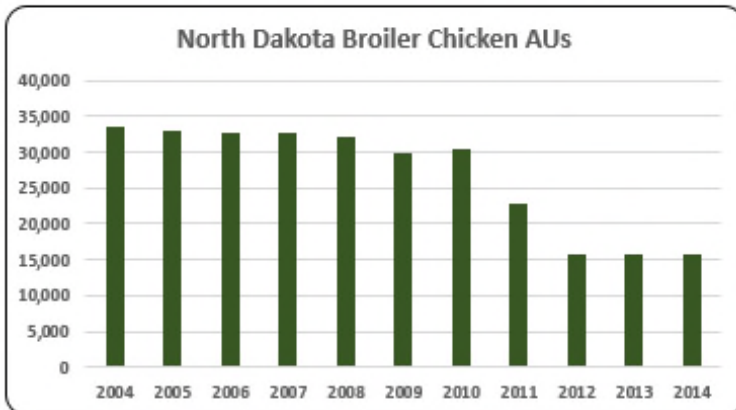
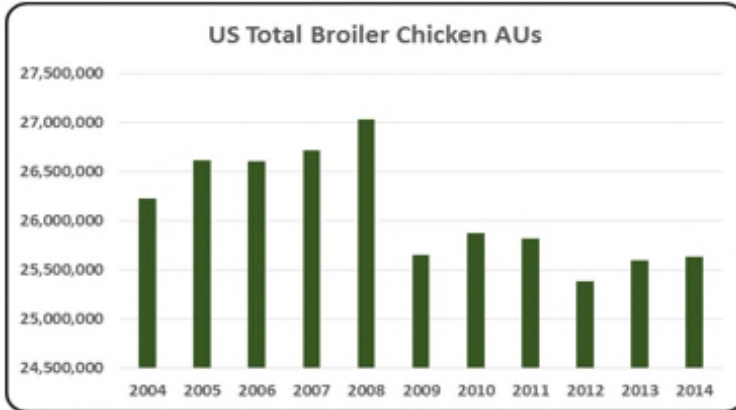
As shown in the accompanying charts and written commentary, certain components of animal agriculture are more present, and therefore more dominant than others. This is due primarily to geography (i.e., weather patterns and access to certain transportation hubs), proximity to high quality, relevant feed ingredients, and the local animal agriculture regulatory framework. In North Dakota, the largest three segments of animal agriculture in terms of AUs during 2014 were: Beef Cows (1,104.1 thousand AUs), Hogs (119.5 thousand AUs), and Turkeys (69.3 thousand AUs). Total animal units in North Dakota during 2014 were 1,334 thousand AUs.



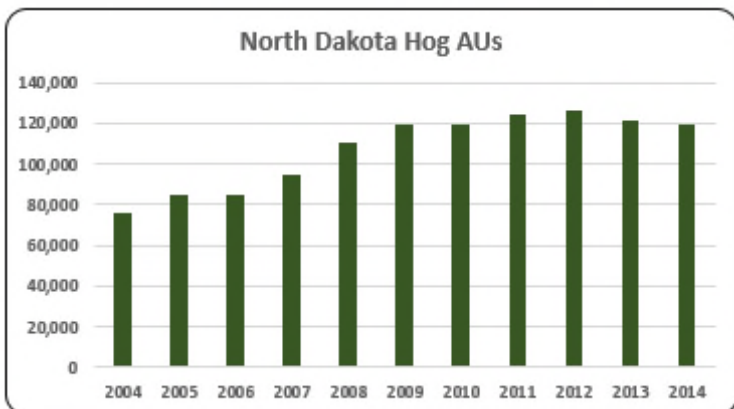
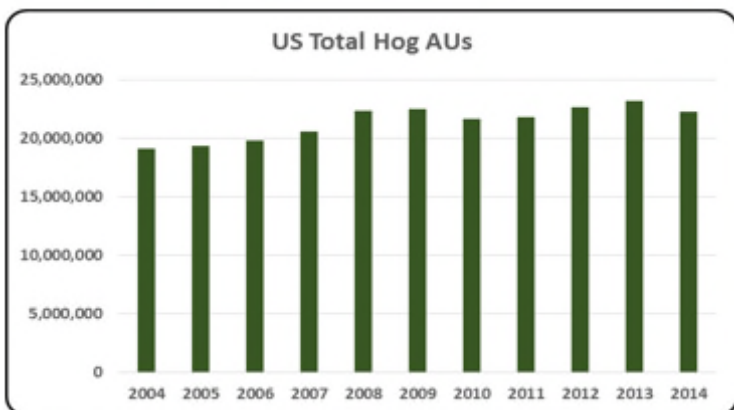
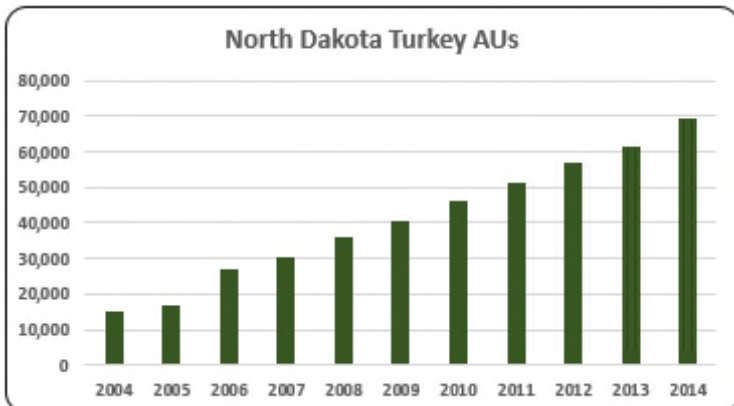
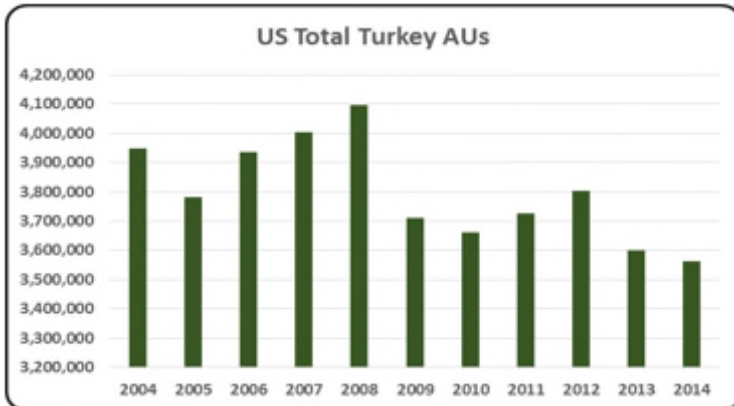
- Overall U.S. total AUs have varied from 2004 to 2014. In 2014 AUs were at an all-time low reflecting, in part, the impact of severe weather on cattle production in some parts of country. During the 2004-14 time period, total AUs in the nation peaked in 2008.



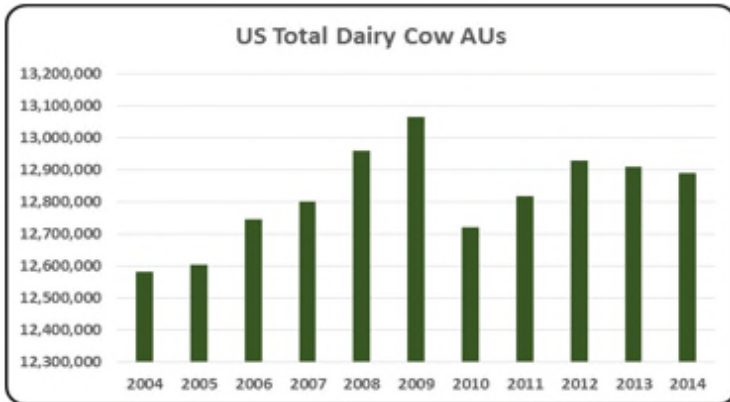
- About 1.13% (1,334.0 thousand) of all AUs in the U.S. were in North Dakota in 2014. Eighty three percent of all AUs in North Dakota were from beef cow production in 2014.



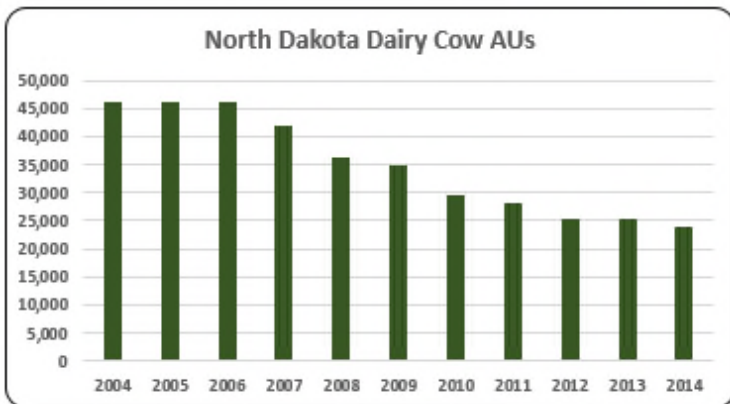
- U.S. broiler production is clustered in a number of states, with Georgia being the largest producer. On average from 2004 to 2014, broiler chicken AUs were about 26.1 million. In 2014, AUs rebounded 1% from the low AUs numbers in 2012 (25.4 million AUs).
- Broiler production in North Dakota is the second smallest animal production in the state with 15,726 broiler AUs in 2014. There was a 53% reduction in broiler production from 2004 to 2014.
- On average, the layer AUs during 2004-2014 were 1.4 million. In 2014 layer AUs were 1.5 million, up 7% from the lowest number in 2009 (1.4 million AUs).
- Layer production in North Dakota was the smallest animal production in the state with only 1,536 layer AUs in 2014. Overall production declined 3% during the last decade.



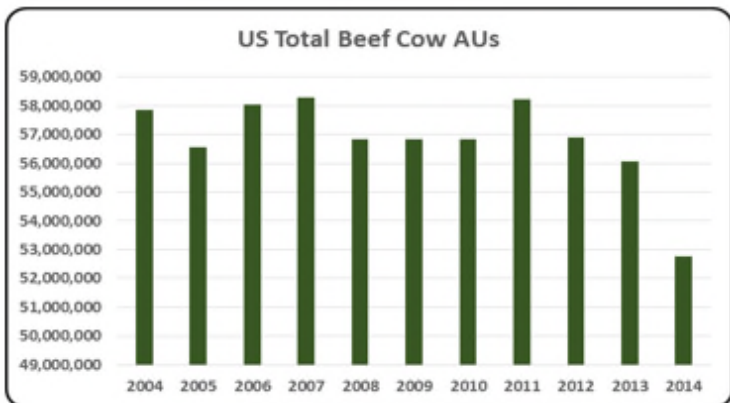
- From 2004 to 2014, the U.S. accounted for 50% of the world’s turkey production. However, in 2014 turkey AUs were the lowest of the decade at 3.5 million, decreasing 13% compared to 2008 (4.1 million turkey AUs) the largest turkey AUs of the decade.
- Turkey production grew 22% in North Dakota from 2004 to 2014. Turkey production represented 5.19% (69,278 turkey AUs) of all animal production in the state in 2014. Turkey production increased 362% throughout the decade.
- On average from 2004 to 2014, hog AUs were about 21.4 million. In 2013 hog AUs reached a high of 23.2 million AUs as prices of main feed ingredients, particularly corn, decreased to pre-2010 price levels. Hog AUs in 2014 decreased 4.4% to 22.3 million AUs year-over-year, primarily due to the porcine epidemic diarrhea virus (PEDv) outbreak. Despite the fluctuation in AUs, the pork supply was relatively stable.
- There were 119,535 hog AUs in North Dakota in 2014. Hog numbers rose 58% from 75,690 in 2004 to 119,535 in 2014.



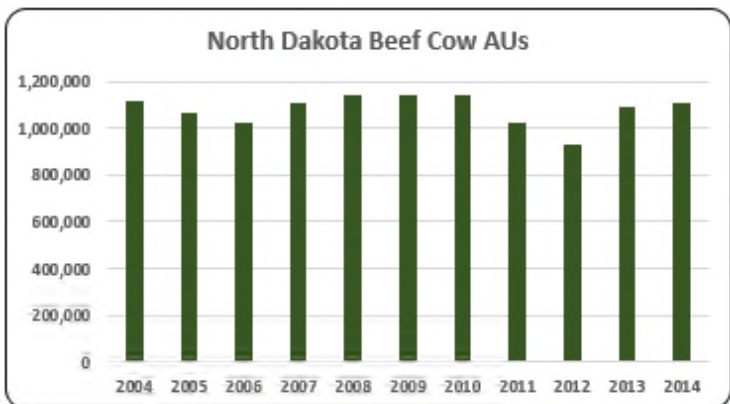
- From 2004 to 2014 dairy cow AUs averaged 12.8 million. In 2014, dairy cow AUs (12.9 million) remained about the same as the previous year but still below the high of 13.1 million AUs, the level in 2009. Despite the fluctuation in AUs, milk supplied has steadily risen.



- Dairy cow production was less than 2% (23,800 dairy cow AUs) of all North Dakota AUs in 2014. Dairy cow production followed a downward trend since 2008.



- From 2004 to 2014 beef cow AUs averaged 56.8 million. In 2014 beef cow AUs decreased to 52.8 million, the lowest of the decade. States that raise a large number of cattle and calves like Texas and Oklahoma were plagued with drought conditions during 2014.



- Beef cow production, the largest animal production in North Dakota, grew 1.2% to 1,104.1 thousand in 2014. The average beef cow AUs was 1,079.9 thousand from 2004 to 2014.

North Dakota Additional Information and Methodology

Animal agriculture is an important part of North Dakota'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:

- Economic impact of animal agriculture to local (state) economies during the 2004-2014 time period
- Soybean meal usage by animal species during the 2013/14 soybean marketing year
- Animal Unit (AU) trends from 2004-2014

Given the long-term presence of animal agriculture in North Dakota, of interest is the degree to which the industry impacts the North Dakota economy. Estimates of output, jobs, earnings, taxes paid, and multipliers for North Dakota 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 Dakota'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 2004-2014 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 Dakota which have occurred. As shown in this state report, North Dakota 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 Dakota. 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 2013-14 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 515.257.6077.

North Dakota 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 Dakota’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 Dakota, \$1.897 to \$2.705 million in total economic activity, \$0.311 to \$0.429 in household wages and 8 to 11 additional jobs are generated in the economy at large.

	Animal Type	Output(\$)	Earnings (\$)	Employment (Jobs)
RIMS II Multipliers	Cattle and Calves	\$ 2.7048	\$ 0.4290	11.1
	Hogs, Pigs, and Other	\$ 1.8966	\$ 0.3107	8.0
	Poultry and Eggs	\$ 2.4467	\$ 0.3877	9.5
	Dairy	\$ 2.1195	\$ 0.3594	9.4

Appendix

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Animal Units (AUs)	Beef Cattle AUs	1,116,450	1,063,950	1,019,325	1,111,575	1,139,025	1,139,025	1,139,025	1,021,125	933,765	1,091,460	1,104,090
	Hog and Pig AUs	75,690	84,300	84,360	95,115	110,685	119,580	119,010	124,425	126,015	121,155	119,535
	Broiler AUs	33,569	32,862	32,641	32,667	32,158	29,899	30,301	22,832	15,871	15,816	15,726
	Turkey AUs	15,000	16,587	27,149	30,198	36,233	40,589	45,934	51,270	56,678	61,552	69,278
	Egg Layer AUs	1,581	1,741	1,680	1,437	1,396	1,221	1,213	1,220	1,489	1,512	1,536
	Dairy AUs	46,200	46,200	46,200	42,000	36,400	35,000	29,400	28,000	25,200	25,200	23,800
	Total Animal Units	1,288,490	1,245,640	1,211,354	1,312,992	1,355,896	1,365,314	1,364,883	1,248,872	1,159,018	1,316,694	1,333,964
Value of Production (\$1,000)	Cattle and Calves (\$1,000)	\$ 702,022	\$ 761,799	\$ 756,351	\$ 599,566	\$ 629,990	\$ 490,746	\$ 655,715	\$ 780,087	\$ 837,759	\$ 857,342	\$ 1,085,847
	Hogs and Pigs (\$1,000)	\$ 38,804	\$ 41,532	\$ 37,696	\$ 35,825	\$ 35,474	\$ 39,733	\$ 51,177	\$ 56,408	\$ 46,692	\$ 52,400	\$ 66,738
	Broilers (\$1,000)	\$ 28,234	\$ 26,745	\$ 20,668	\$ 24,575	\$ 25,292	\$ 21,908	\$ 23,059	\$ 20,316	\$ 15,810	\$ 19,261	\$ 20,205
	Turkeys (\$1,000)	\$ 10,560	\$ 10,989	\$ 19,852	\$ 23,056	\$ 28,164	\$ 31,362	\$ 36,053	\$ 40,638	\$ 45,368	\$ 49,444	\$ 55,976
	Eggs (\$1,000)	\$ 6,938	\$ 4,200	\$ 4,656	\$ 7,643	\$ 9,211	\$ 6,556	\$ 7,197	\$ 7,890	\$ 8,849	\$ 9,998	\$ 11,609
	Milk (\$1,000)	\$ 85,738	\$ 70,200	\$ 58,750	\$ 82,140	\$ 77,330	\$ 50,310	\$ 61,056	\$ 69,000	\$ 65,583	\$ 67,859	\$ 76,464
	Other	\$ 6,633	\$ 6,678	\$ 5,784	\$ 5,482	\$ 5,962	\$ 5,795	\$ 7,052	\$ 6,151	\$ 6,139	\$ 6,127	\$ 6,128
	Sheep and Lambs (\$1,000)	\$ 6,524	\$ 6,581	\$ 5,699	\$ 5,409	\$ 5,901	\$ 5,747	\$ 7,016	\$ 6,127	\$ 6,127	\$ 6,127	\$ 6,128
	Aquaculture (\$1,000)	\$ 109	\$ 97	\$ 85	\$ 73	\$ 61	\$ 48	\$ 36	\$ 24	\$ 12	\$ -	\$ -
	Total (\$1,000)	\$ 878,929	\$ 922,143	\$ 903,757	\$ 778,287	\$ 811,422	\$ 646,410	\$ 841,309	\$ 980,491	\$ 1,026,200	\$ 1,062,431	\$ 1,322,968

Ag Census Data Category	Animal Type	1997	2002	2007	2012
Number of Farms by NAICS	Beef cattle ranching and farming (112111)	7,600	7,154	5,961	4,949
	Cattle feedlots (112112)	378	378	252	157
	Dairy cattle and milk production (11212)	662	410	212	90
	Hog and pig farming (1122)	207	90	74	66
	Poultry and egg production (1123)	72	63	130	105
	Sheep and goat farming (1124)	338	307	276	251
	Animal aquaculture and other animal production (1125,1129)	871	1,147	1,415	2,085
Value of Sales (\$1,000)	Cattle and Calves	499,719	625,070	856,489	1,063,287
	Hogs and Pigs	34,861	25,888	34,910	50,366
	Poultry and Eggs	27,371	22,365	28,496	withheld
	Milk and Other Dairy Products	80,128	65,450	78,959	67,079
	Aquaculture	withheld	withheld	withheld	738
	Other (calculated)	36,135	34,221	46,843	61,862
	Total	678,214	772,994	1,045,697	1,243,332
Input Purchases	Livestock and poultry purchased	(Farms) 8,030	7,129	6,074	7,183
		\$1,000 106,412	124,054	204,142	291,801
	Breeding livestock purchased	(Farms) n/a	5,406	4,901	5,772
		\$1,000 n/a	31,117	59,706	101,420
	Other livestock and poultry purchased	(Farms) n/a	2,841	2,022	2,666
		\$1,000 n/a	92,937	144,436	190,381
	Feed purchased	(Farms) 12,996	11,956	9,597	11,830
	\$1,000 125,867	118,559	158,337	324,796	

	Animal Type	Output (\$1,000)	Earnings (\$1,000)	Employment (Jobs)	Taxes Paid (\$1,000)
2014 Animal Agriculture	Cattle and Calves	\$ 2,936,999	\$ 465,828	12,002	\$ 107,839
	Hogs, Pigs, and Other	\$ 138,197	\$ 22,639	580	\$ 5,241
	Poultry and Eggs	\$ 214,798	\$ 34,037	838	\$ 7,879
	Dairy	\$ 162,065	\$ 27,481	719	\$ 6,362
	Total	\$ 3,452,060	\$ 549,985	14,139	\$ 127,322
Change from 2004 to 2014	Cattle and Calves	\$ 557,321	\$ 88,395	2,277	\$ 20,463
	Hogs, Pigs, and Other	\$ 30,199	\$ 4,947	127	\$ 1,145
	Poultry and Eggs	\$ 74,569	\$ 11,816	291	\$ 2,735
	Dairy	\$ (65,674)	\$ (11,136)	(291)	\$ (2,578)
	Total	\$ 596,415	\$ 94,022	2,404	\$ 21,766
	Animal Type	Output(\$)	Earnings (\$)	Employment (Jobs)	
RIMS II Multipliers	Cattle and Calves	\$ 2.7048	\$ 0.4290	11.1	
	Hogs, Pigs, and Other	\$ 1.8966	\$ 0.3107	8.0	
	Poultry and Eggs	\$ 2.4467	\$ 0.3877	9.5	
	Dairy	\$ 2.1195	\$ 0.3594	9.4	
Tax Rates	Federal effective income tax rate			12.7%	
	Federal Social Security tax rate			7.7%	
	State Effective Rate			2.8%	
	Total			23.2%	

Sources: 1997, 2002, 2007 and 2012 Census of Agriculture, USDA/NASS Survey Data, RIMS II Multipliers (U.S. Bureau of Economic Analysis), Tax Policy Institute and Tax Foundation.