

# Economic Analysis of Animal Agriculture 2005-2015

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## *NORTH DAKOTA*

**A Report for  
United Soybean Board**



**September 2016**



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## North Dakota Executive Summary

The use of soybean meal as a key feed ingredient is an important 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 the State of North Dakota. The success of North Dakota animal agriculture in turn has an impact on the rest of the state and regional economies. For example, in the State of North Dakota during 2015 animal agriculture contributed:

- \$3.0 billion in economic output
- 14,100 jobs
- \$581.6 million in earnings
- \$134.6 million in income taxes paid at local, state, and federal levels
- \$129.9 million in the form of property taxes

Plus, from 2005-2015 animal agriculture in North Dakota has increased economic output by over \$373.3 million, boosted household earnings by \$71.7 million, contributed 1,704 additional jobs and paid \$16.6 million in additional tax revenues.

North Dakota's animal agriculture consumed almost 96.7 thousand tons of soybean meal in 2015. This soybean meal was fed primarily to:

- Beef Cows (49.9 thousand tons)
- Hogs (38.0 thousand tons)
- Dairy Cows (3.1 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. It is expected that animal agriculture will continue to be a 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 2015, North Dakota's animal agriculture contributed the following to the economy:

- About \$3.0 billion in economic output
- \$581.6 million in household earnings
- 14,100 jobs
- \$134.6 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:

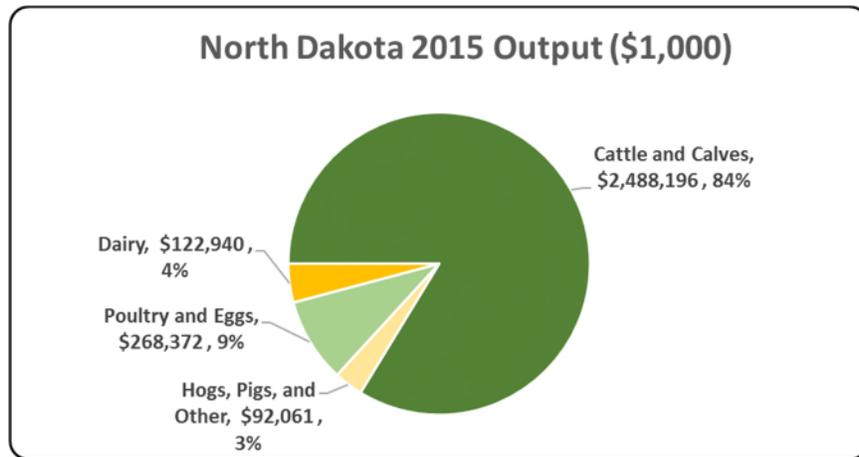
- Increased economic output by \$373.3 million
- Boosted household earnings by \$71.7 million
- Added 1,704 jobs
- Paid an additional \$16.6 million in income taxes

Below is a table which demonstrates this decade of change.

Measure	2015	Change 2005-2015	% Change 2005-2015
Output (\$1,000)	\$ 2,971,569	\$ 373,326	14.37%
Earnings (\$1,000)	\$ 581,590	\$ 71,674	14.06%
Employment (Jobs)	14,100	1,704	13.75%
Income Taxes Paid (\$1,000)	\$ 134,638	\$ 16,593	14.06%
Property Taxes Paid in 2012 (\$1,000)	\$ 129,909		

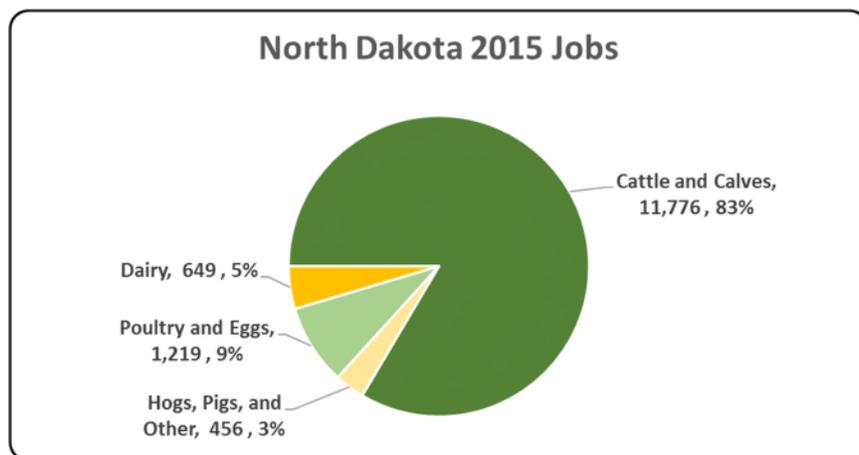
### North Dakota Output

“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 \$3.0 billion.



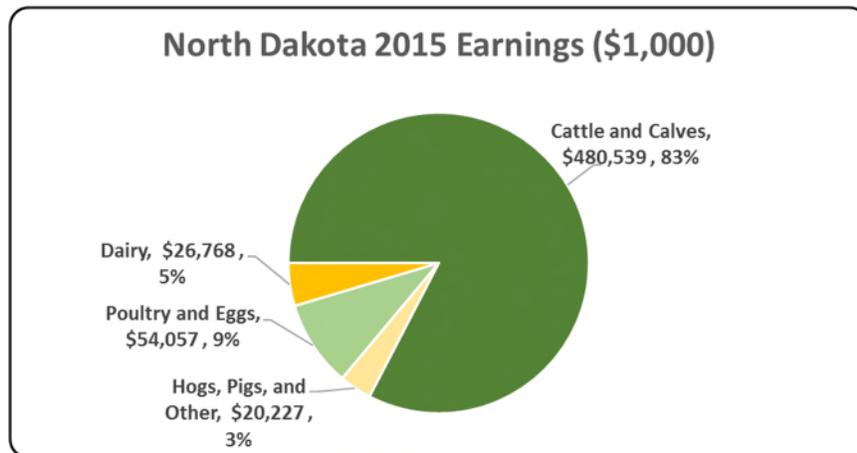
### North Dakota Jobs

“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 14,100 jobs within and outside of animal agriculture.



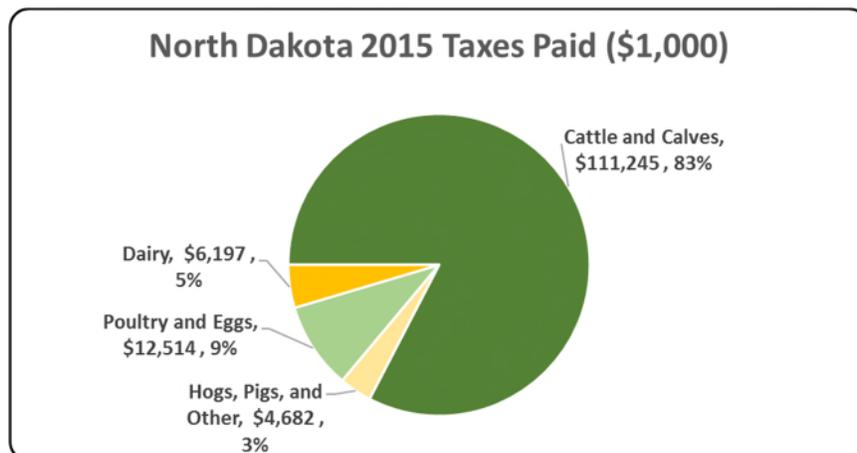
### North Dakota Earnings

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 \$581.6 million to household earnings in 2015.



### North Dakota Taxes Paid by Animal Agriculture

North Dakota’s animal agriculture is also a significant source of tax revenue. In 2015, the state’s animal agriculture industry paid about \$134.6 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.



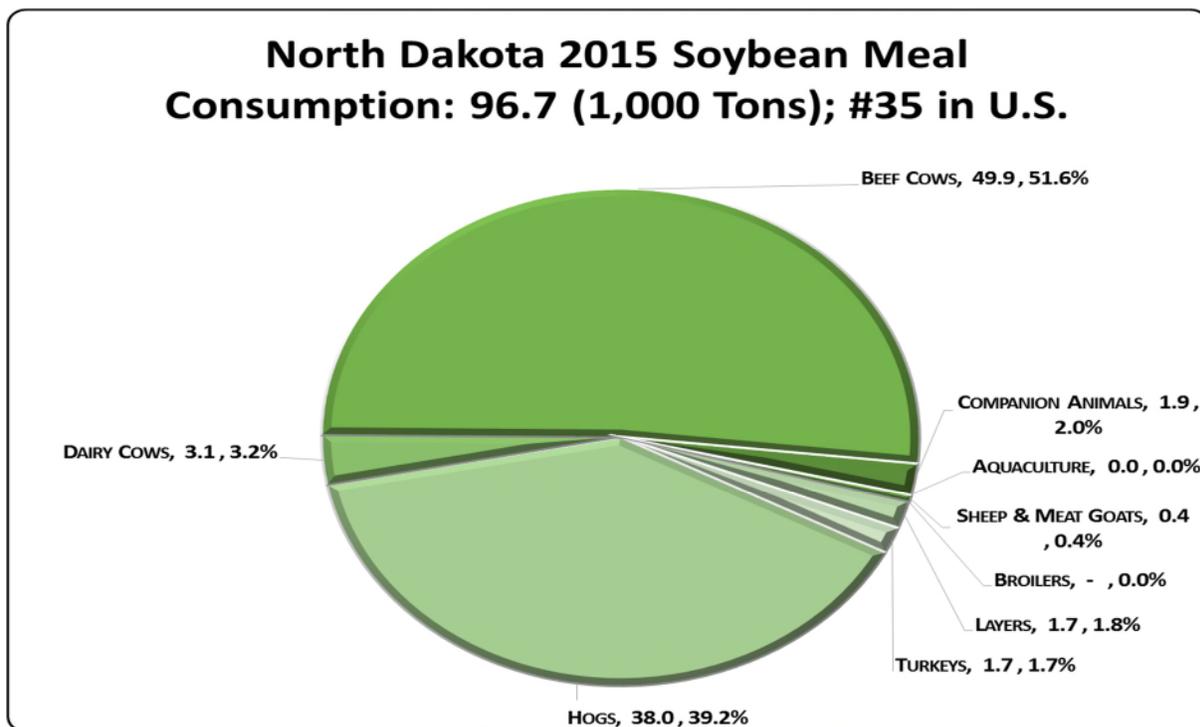
## North Dakota Animal Agriculture Soybean Meal Consumption

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 2014-15 soybean marketing year by up to sixteen specific animal species has been estimated.

North Dakota’s animal agriculture consumed almost 96.7 thousand tons of soybean meal in 2015, 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 (49.9 thousand tons)
- Hogs (38.0 thousand tons)
- Dairy Cows (3.1 thousand tons)

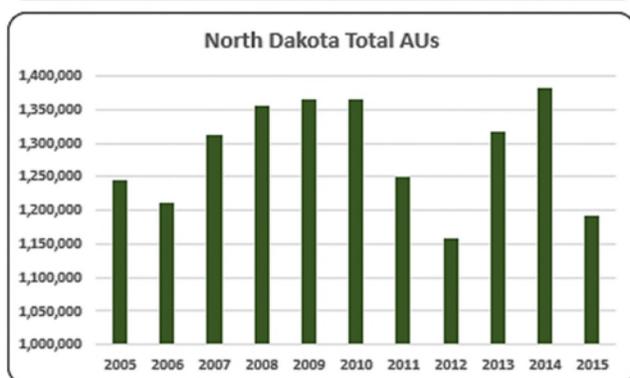
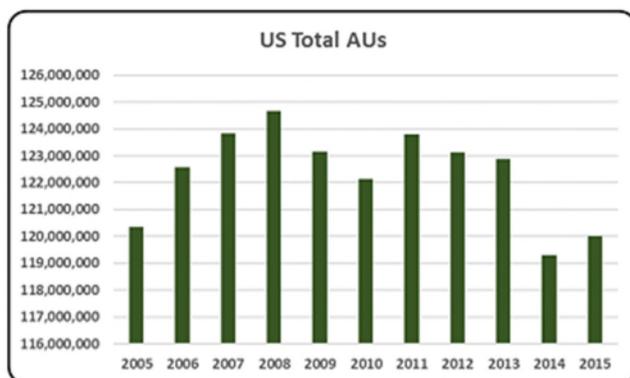


## North Dakota Animal Unit (AU) Trends

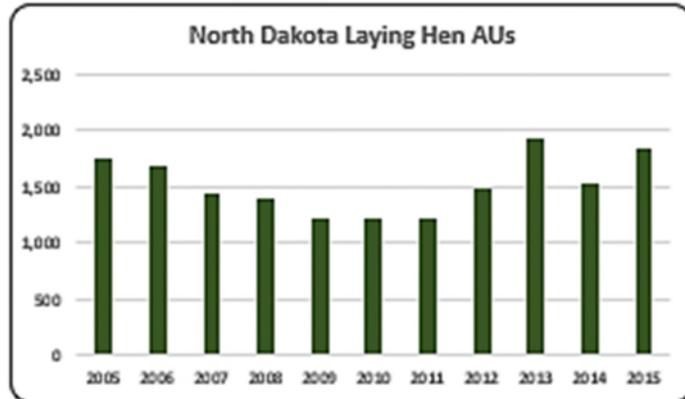
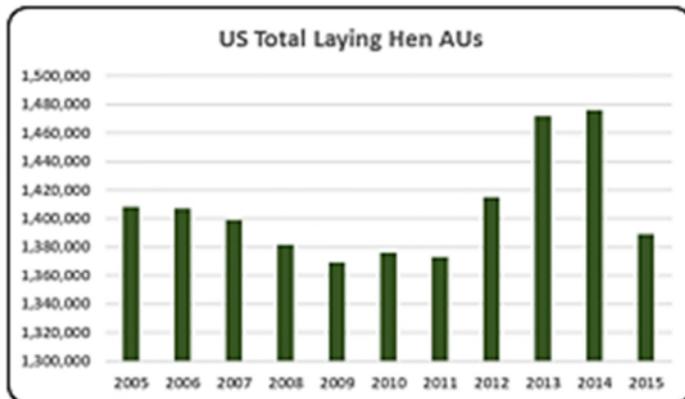
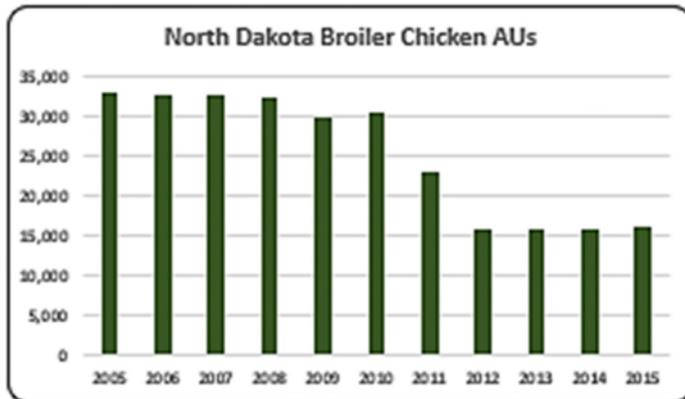
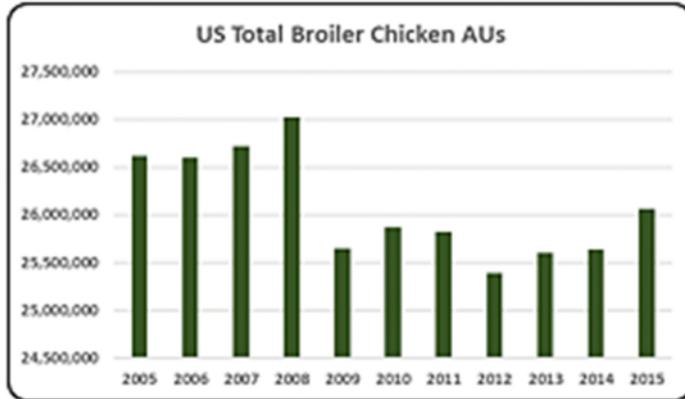
Over time, prices of feed, meat, eggs and milk, as well as levels of demand for these products in the United States and abroad have an impact on the size of animal agriculture in the State of North Dakota. Due to this reality, using a single year as a measure of the presence and strength of a sector 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 2015 were: Beef Cows (947,970 AUs), Hogs (128,940 AUs), and Turkeys (74,198 AUs). Total animal units in North Dakota during 2015 were 1.2 million AUs.



- Overall U.S. total AUs have varied from 2005 to 2015. 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 2005-15 time period, total AUs in the nation peaked in 2008.
- About 1% (1.2 million) of all AUs in the U.S. were in North Dakota in 2015. About 79.5% of all AUs in North Dakota were from beef cow production in 2015.

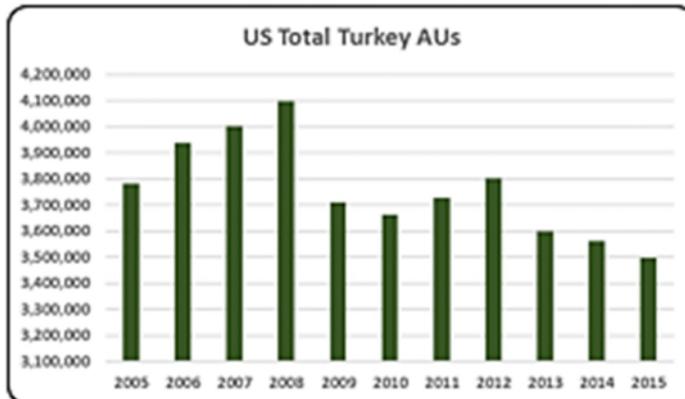


- U.S. broiler production is clustered in a number of states, with Georgia being the largest producer. On average from 2005 to 2015, broiler chicken AUs were about 26.0 million. In 2015, AUs rebounded 3% from the low AUs numbers in 2012 (25.4 million AUs).

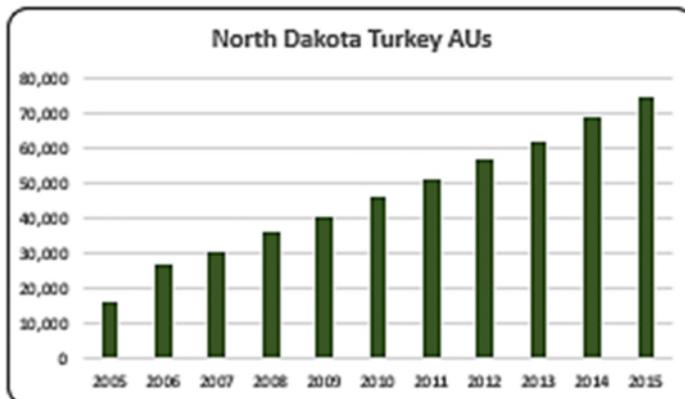
- Broiler production in North Dakota is the second smallest animal production in the state with 16,132 broiler AUs in 2015. There was a 51% reduction in broiler production from 2005 to 2015.

- On average, the layer AUs during 2005-2015 were 1.4 million. In 2015 layer AUs were 1.3 million, down 6% from the 2014 decade high (1.4 million AUs). This drastic decrease in 2015 was due to the losses in major egg laying states from the avian influenza outbreak.

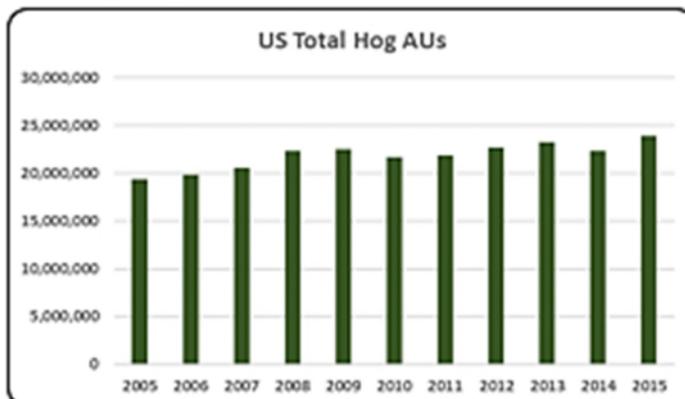
- Layer production in North Dakota was the smallest animal production in the state with only 1,848 layer AUs in 2015. Overall production declined 6% during the last decade.



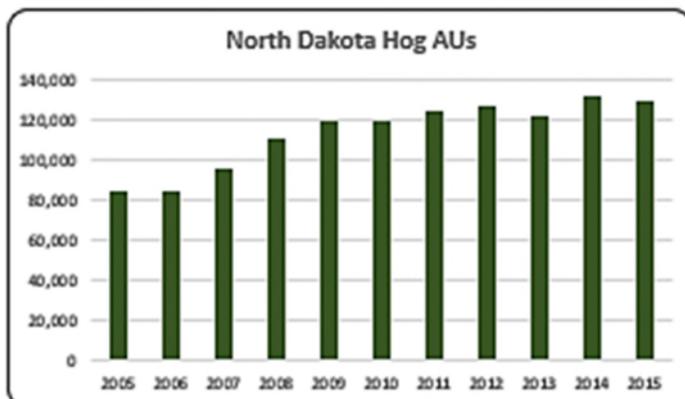
- In 2015 turkey AUs were the lowest of the decade at 3.5 million, decreasing 15% compared to 2008 (4.1 million turkey AUs) the largest turkey AUs of the decade. The most recent contributor to this decline has been avian influenza.



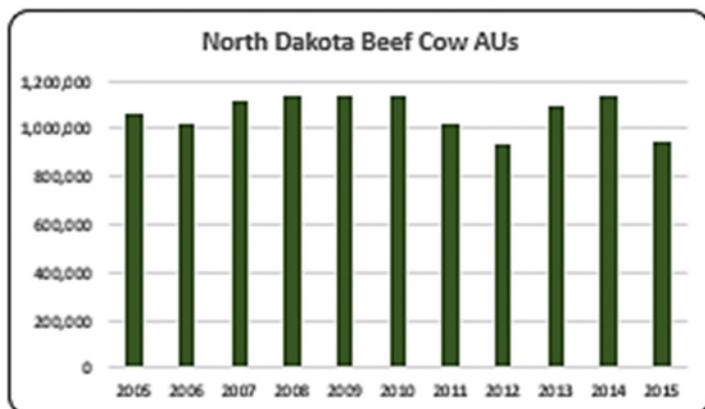
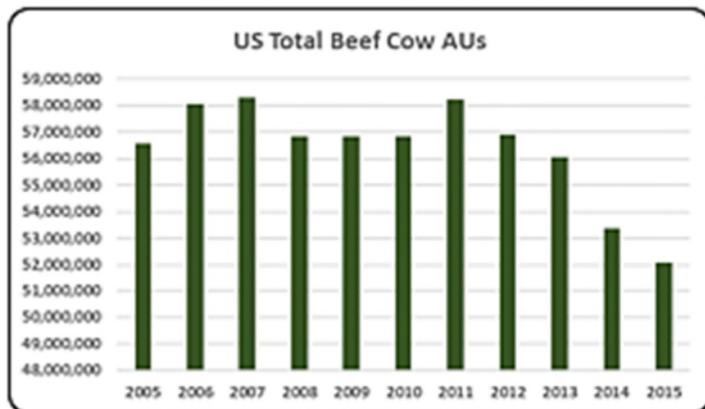
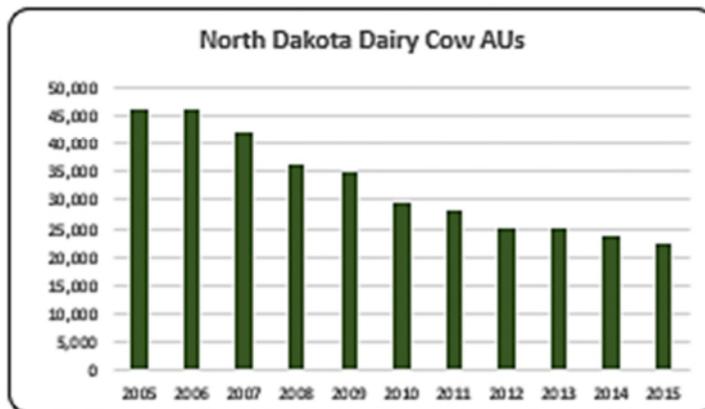
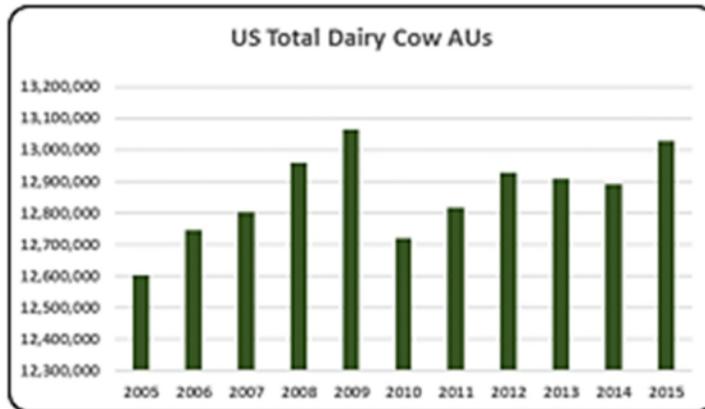
- Turkey production grew 34.7% in North Dakota from 2005 to 2015. Turkey production represented 6.22% (74,198 turkey AUs) of all animal production in the state in 2015.



- On average from 2005 to 2015, hog AUs were about 21.8 million. Hog AUs in 2015 increased 24% to 23.9 million AUs compared to the decade low in 2005 (19.4 million AUs). Despite the fluctuation in AUs, the pork supply was relatively stable.



- There were 128,940 hog AUs in North Dakota in 2015. Hog numbers rose 53% from 84,300 in 2004 to 128,940 in 2015.



- From 2005 to 2015 dairy cow AUs averaged 12.8 million. In 2015, dairy cow AUs (13.0 million) finally reached near the 2009 high of 13.1 million AUs. Milk supplies have steadily risen.
- Dairy cow production was less than 1.9% (22,400 dairy cow AUs) of all North Dakota AUs in 2015. Dairy cow production followed a downward trend since 2008.
- From 2005 to 2015 beef cow AUs averaged 56.3 million. In 2015 beef cow AUs decreased to 52.0 million, the lowest of the decade. States that traditionally raise a lot of cattle like Texas and Oklahoma continue to work through the lingering effects of the drought of the last several years.
- Beef cow production, the largest animal production in North Dakota, fell to 947,970 in 2015. The average beef cow AUs was 1.1 million from 2005 to 2015.

## 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 2005-2015 time period
- Soybean meal usage by animal species during the 2014/15 soybean marketing year
- Animal Unit (AU) trends from 2005-2015

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 2005-2015 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 2014-15 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](mailto: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, \$1.66 to \$2.37 million in total economic activity, \$0.36 to \$0.47 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	\$ 2.375	\$ 0.459	11.2
	Hogs, Pigs, and Other	\$ 1.657	\$ 0.364	8.2
	Poultry and Eggs	\$ 2.343	\$ 0.472	10.6
	Dairy	\$ 2.166	\$ 0.472	11.4

## Appendix

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
<b>Animal Units (AUs)</b>	Beef Cattle AUs	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	1,140,090	947,970
	Hog and Pig AUs	84,300	84,360	95,115	110,685	119,580	119,010	124,425	126,015	121,155	131,835	128,940
	Broiler AUs	32,862	32,641	32,667	32,158	29,899	30,301	22,832	15,871	15,816	15,726	16,132
	Turkey AUs	16,587	27,149	30,198	36,233	40,589	45,934	51,270	56,678	61,552	68,830	74,198
	Egg Layer AUs	1,741	1,680	1,437	1,396	1,221	1,213	1,220	1,489	1,927	1,536	1,848
	Dairy AUs	46,200	46,200	42,000	36,400	35,000	29,400	28,000	25,200	25,200	23,800	22,400
	<b>Total Animal Units</b>	<b>1,245,640</b>	<b>1,211,354</b>	<b>1,312,992</b>	<b>1,355,896</b>	<b>1,365,314</b>	<b>1,364,883</b>	<b>1,248,872</b>	<b>1,159,018</b>	<b>1,317,110</b>	<b>1,381,817</b>	<b>1,191,487</b>
<b>Value of Production (\$1,000)</b>	Cattle and Calves (\$1,000)	\$ 761,799	\$ 756,351	\$ 599,566	\$ 629,990	\$ 490,746	\$ 655,715	\$ 780,087	\$ 837,759	\$ 857,342	\$ 1,085,847	\$ 1,047,838
	Hogs and Pigs (\$1,000)	\$ 41,532	\$ 37,696	\$ 35,825	\$ 35,474	\$ 39,733	\$ 51,177	\$ 56,408	\$ 46,692	\$ 52,400	\$ 66,738	\$ 48,891
	Broilers (\$1,000)	\$ 27,615	\$ 21,393	\$ 25,211	\$ 25,756	\$ 22,222	\$ 23,223	\$ 20,331	\$ 15,814	\$ 19,269	\$ 20,215	\$ 17,636
	Turkeys (\$1,000)	\$ 10,881	\$ 19,663	\$ 22,840	\$ 30,147	\$ 34,349	\$ 40,403	\$ 46,284	\$ 52,109	\$ 57,053	\$ 66,208	\$ 72,218
	Eggs (\$1,000)	\$ 4,200	\$ 4,656	\$ 7,643	\$ 9,211	\$ 6,556	\$ 7,197	\$ 7,890	\$ 8,849	\$ 9,998	\$ 16,003	\$ 24,673
	Milk (\$1,000)	\$ 70,200	\$ 58,750	\$ 82,140	\$ 77,330	\$ 50,310	\$ 61,056	\$ 69,000	\$ 65,583	\$ 67,859	\$ 76,464	\$ 56,772
	Other	\$ 6,678	\$ 5,784	\$ 5,482	\$ 5,962	\$ 5,795	\$ 7,052	\$ 6,364	\$ 6,432	\$ 6,501	\$ 6,581	\$ 6,661
	Sheep and Lambs (\$1,000)	\$ 6,581	\$ 5,699	\$ 5,409	\$ 5,901	\$ 5,747	\$ 7,016	\$ 6,340	\$ 6,420	\$ 6,501	\$ 6,581	\$ 6,661
	Aquaculture (\$1,000)	\$ 97	\$ 85	\$ 73	\$ 61	\$ 48	\$ 36	\$ 24	\$ 12	\$ -	\$ -	\$ -
	<b>Total (\$1,000)</b>	<b>\$ 922,905</b>	<b>\$ 904,294</b>	<b>\$ 778,707</b>	<b>\$ 813,870</b>	<b>\$ 649,712</b>	<b>\$ 845,823</b>	<b>\$ 986,365</b>	<b>\$ 1,033,238</b>	<b>\$ 1,070,421</b>	<b>\$ 1,338,056</b>	<b>\$ 1,274,689</b>

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	
	<b>Total</b>	<b>678,214</b>	<b>772,994</b>	<b>1,045,697</b>	<b>1,243,332</b>	
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)
<b>2015 Animal Agriculture</b>	Cattle and Calves	\$ 2,488,196	\$ 480,539	11,776	\$ 111,245
	Hogs, Pigs, and Other	\$ 92,061	\$ 20,227	456	\$ 4,682
	Poultry and Eggs	\$ 268,372	\$ 54,057	1,219	\$ 12,514
	Dairy	\$ 122,940	\$ 26,768	649	\$ 6,197
	<b>Total</b>	\$ 2,971,569	\$ 581,590	14,100	\$ 134,638
<b>Change from 2005 to 2015</b>	Cattle and Calves	\$ 292,824	\$ 56,552	1,386	\$ 13,092
	Hogs, Pigs, and Other	\$ (4,898)	\$ (1,076)	(24)	\$ (249)
	Poultry and Eggs	\$ 146,950	\$ 29,599	667	\$ 6,852
	Dairy	\$ (61,550)	\$ (13,401)	(325)	\$ (3,102)
	<b>Total</b>	\$ 373,326	\$ 71,674	1,704	\$ 16,593
<b>RIMS II Multipliers</b>	Animal Type	Output(\$)	Earnings (\$)	Employment (Jobs)	
	Cattle and Calves	\$ 2.375	\$ 0.459	11.2	
	Hogs, Pigs, and Other	\$ 1.657	\$ 0.364	8.2	
	Poultry and Eggs	\$ 2.343	\$ 0.472	10.6	
	Dairy	\$ 2.166	\$ 0.472	11.4	
<b>Tax Rates</b>	Federal effective income tax rate				12.7%
	Federal Social Security tax rate				7.7%
	State Effective Rate				2.8%
	<b>Total</b>				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.