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**Results of the North Dakota Land Valuation Model  
for the  
2011 Agricultural Real Estate Assessment**

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## TABLE OF CONTENTS

	<u>Page</u>
List of Tables .....	ii
List of Figures .....	ii
Abstract .....	iii
North Dakota Land Valuation Model .....	1
Capitalization Rate.....	1
Cost of Production Index .....	2
Results: All Agricultural Land Value .....	2
Five-year Trend: All Agricultural Land Value.....	4
Results: Cropland Value .....	5
Five-year Trend: Cropland Value .....	6
Results: Non-Cropland Value .....	7
Five-year Trend: Non-Cropland Value .....	7
Capitalized Average Annual Values per Acre by County.....	7
Market Value of North Dakota Farm Land.....	10
Five-year Trend: Market Value of Cropland.....	11
Market Value of Pasture .....	13
Five-year Trend: Market Value of Pasture.....	14
Conclusions.....	15
References.....	16

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	North Dakota Capitalized Average Annual Values Per Acre by County for 2010.....	8
2	North Dakota Capitalized Average Annual Values Per Acre by County for 2011 .....	9

## LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Percent Change in Average Value of All Agricultural Land, 2010-2011 .....	3
2	Percent Change in Average Value of All Agricultural Land, 2006-2011 .....	4
3	Percent Change in Average Value of Cropland, 2010-2011 .....	5
4	Percent Change in Average Value of Cropland, 2006-2011 .....	6
5	Percent Change in Estimated Market Value of Cropland, 2010-2011 .....	11
6	Percentage Change in Estimated Market Value of Cropland, 2006-2011 .....	12
7	Percent Change in Estimated Market Value of Pasture, 2010-2011 .....	13
8	Percentage Change in Estimated Market Value of Pasture, 2006-2011 .....	14

## ABSTRACT

This report summarizes the 2011 results of the North Dakota Land Valuation Model. The model is used annually to estimate average land values by county, based on the value of production from cropland and non-cropland. The county land values developed from this procedure form the basis for the 2011 valuation of agricultural land for real estate tax assessment. The average value for all agricultural land in a county from this analysis is multiplied by the total acres of agricultural land on the county abstract to determine each county's total agricultural land value for taxation purposes. The State Board of Equalization compares this value with the total value assessed to agricultural property in each county. Each county is required by state statute to assess a total value of agricultural property within 5 percent of this value.

The average value per acre of all agricultural land in North Dakota increased by 5.4 percent from 2010 to 2011 based on the value of production. The value of cropland increased by 6.0 percent, and non-cropland value decreased by 0.40 percent. The formula capitalization rate was below the minimum set by the State Legislature, therefore the minimum rate of 7.4 percent was used.

The increase in the values for cropland and all agricultural land was due to the increased value of crop production. The value of production for most counties has been considerably higher since 2007 than prior years. This increase in value of production is a combination of increased yields, higher prices and a change in cropping mix. The change in crop revenue impacted land values from a negative 0.52 percent in Pembina County to an increase of 13.12 percent in Hettinger County. The capitalization rate change increased land valuations by 4.05 percent in all counties; while the cost of production index decreased land values in all counties by 5.72 percent.

Changes in market value are included for comparison. Market value data are from the annual County Rents and Values survey conducted by North Dakota Agricultural Statistics Service.

**Key Words:** Land valuation, real estate assessment, agricultural land



# RESULTS OF THE NORTH DAKOTA LAND VALUATION MODEL FOR THE 2011 AGRICULTURAL REAL ESTATE ASSESSMENT

Dwight G. Aakre and Ronald Haugen<sup>1</sup>

## NORTH DAKOTA LAND VALUATION MODEL

State statute mandates that the Department of Agribusiness and Applied Economics at North Dakota State University annually compute an estimate of 1) the average value per acre of agricultural lands on a statewide and countywide basis, and 2) the average value per acre for cropland and non-cropland (N.D.C.C. 57-02-27.2). These estimates are provided to the State Tax Department.

The model determines agricultural land values as the landowner share of gross returns divided by the capitalization rate. *Landowner share of gross returns* is the portion of revenue generated from agricultural land that is assumed to be received by the landowner, and is expected to reflect current rental rates. The Legislature has specified that the landowner share of gross returns is 30 percent of gross returns for all crops except sugar beets and potatoes (20 percent), non-cropland (25 percent), and irrigated land (50 percent of the dry land rate).

### Capitalization Rate

The capitalization rate is an interest rate that reflects the general market rate of interest adjusted for the risk associated with a particular investment or asset (in this case, agricultural land in North Dakota). The Legislature specified the gross Federal Land Bank (Agri-Bank, FCB) mortgage interest rate for North Dakota be used as the basis for computing the capitalization rate. The capitalization rate used in the North Dakota Land Valuation model is a twelve-year rolling average with the high and low rates dropped. The 2003 Legislature amended the capitalization rate formula by introducing a minimum level of 9.5 percent with no upper limit. The 2005 Legislature amended the capitalization rate formula again, specifying a rate no lower than 8.9 percent to be used for the 2005 analysis. For subsequent years the capitalization rate was not to be lower than 8.3 percent. The 2009 Legislature amended the capitalization rate formula to set a minimum of 8.0 percent for 2009, 7.7 percent for 2010 and 7.4 percent for 2011. The capitalization rate calculated according to the formula was 6.25 percent. As a result, the minimum value of 7.4 percent was used for the 2011 assessment. The decrease of 30 basis points in the capitalization rate raised the land values by 4.0 percent without any other changes.

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## **Cost of Production Index**

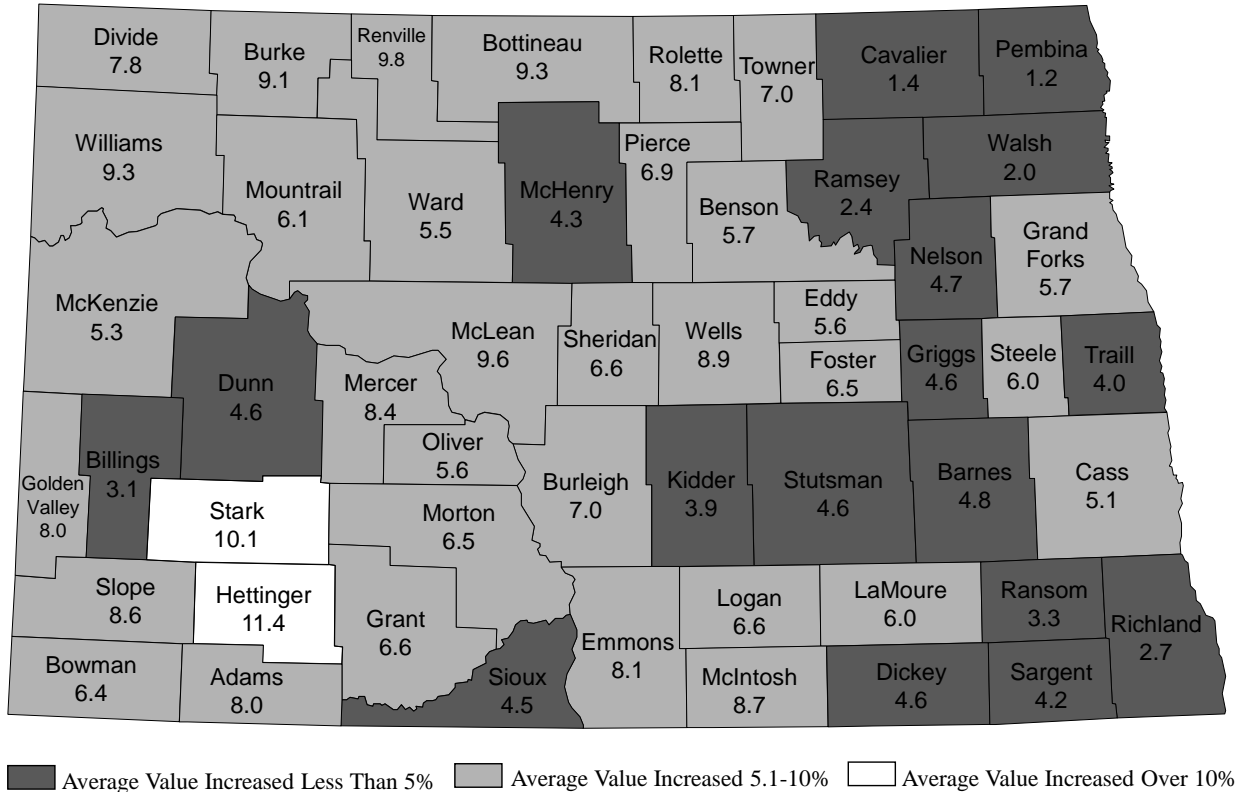
Beginning with the analysis for the 1999 assessment, a cost of production index was added to the land valuation model to account for the increasing proportion of the total cost of production represented by variable costs. The source of data for this index is the *Items Used For Production* from the *Prices Paid Index* published by National Agricultural Statistics Service. The index developed for this analysis was determined by averaging the values of the latest ten years after dropping the high and low values; and dividing this value by the base index. The base index was developed by averaging the index values from the years 1989 through 1995 after dropping the high and low values. The base index value is 102. The resulting index value used in the 2011 analysis was 139.3382, which resulted in a reduction in the landowner share of gross returns of 28.23 percent. The landowner share of gross returns is the amount that is capitalized to determine the land values. Therefore, land values are 28.23 percent lower than they would have been if the cost of production index was not included in the model.

The index used for 2011 increased from 131.375 in 2010, for a one-year change of 7.9632 points, the largest year-to-year increase since the cost of production index was added to the model. This change in the cost of production index from 2010 has the effect of reducing calculated land values by 5.72 percent, more than offsetting the increase caused by the lower capitalization rate.

## **RESULTS: ALL AGRICULTURAL LAND VALUE**

Valuation of all agricultural land in North Dakota, for the 2011 assessment, increased by 5.4 percent or \$17.97 per acre over the previous year. The largest percentage increases occurred in Hettinger County at 11.4 percent and Stark County at 10.1 percent. Values for all other counties increased less than 10 percent. Results are shown in Figure 1.

**Figure 1. Percent Change in Average Value of All Agricultural Land, 2010-2011**

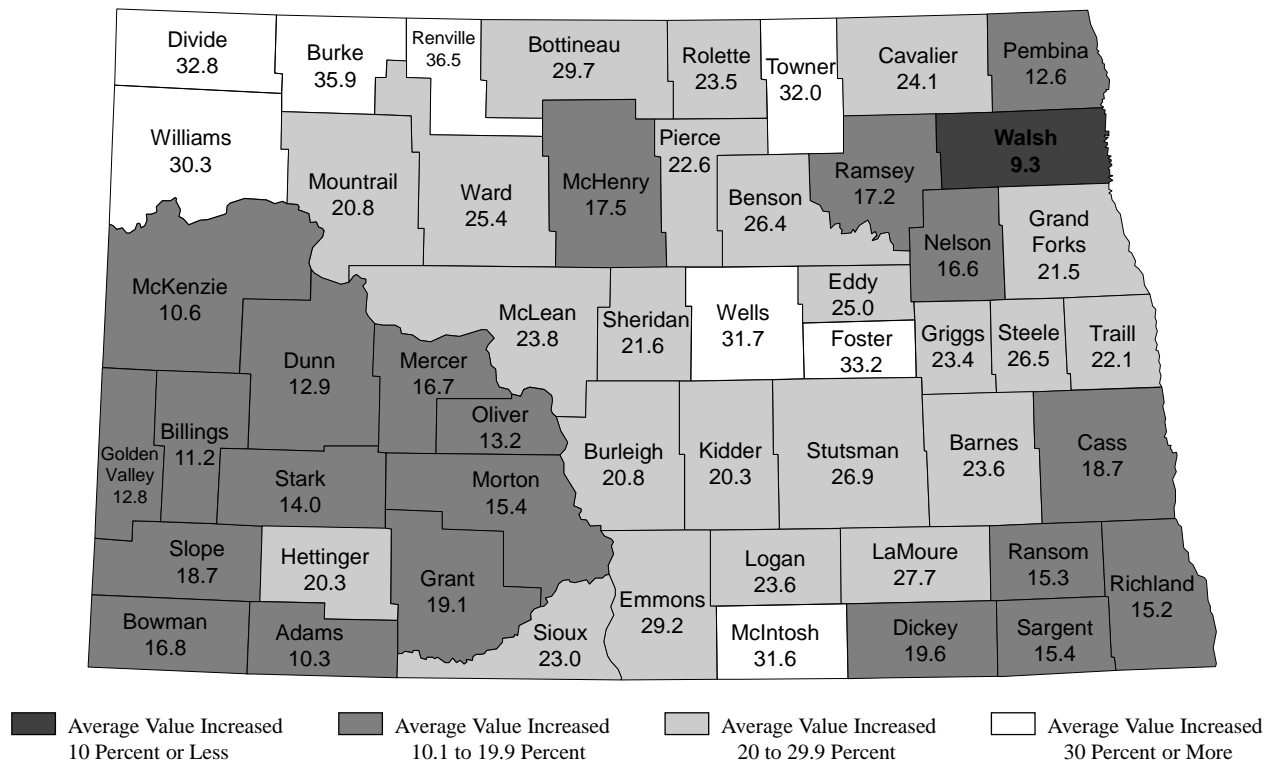


The value for all agricultural land is a weighted average of cropland and non-cropland in each county. Calculated values for cropland generally are three to five times the value of non-cropland in each county. Therefore, a shift in acres between these two categories will alter the all land value even if all other factors remain unchanged. County Directors of Tax Equalization are surveyed each year to determine total taxable acres of cropland and non-cropland as well as inundated land for each category. Changes in reported acres tend to be minimal. Shifting acres from cropland to non-cropland results in a lower value for all agricultural land independent of what happens to gross revenue, the capitalization rate and the cost of production index.

## Five-Year Trend: All Agricultural Land Value

Estimated values for 2011 were compared with values estimated for 2006 to see how they have changed over time. The percent change in value by county is shown in Figure 2. The average value for all agricultural land in North Dakota increased 22.7 percent from 2006 to 2011. Values increased 30 percent or more in eight counties, Williams, Divide, Burke and Renville in the northwestern corner of the state, along with Towner, Wells, Foster and McIntosh counties. Twenty-three counties experienced increases from 20.0 to 29.9 percent. Land values in 21 counties increased between 10.0 and 19.9 percent. Only Walsh County increased less than 10.0 percent.

**Figure 2. Percent Change in Average Value of All Agricultural Land, 2006-2011**

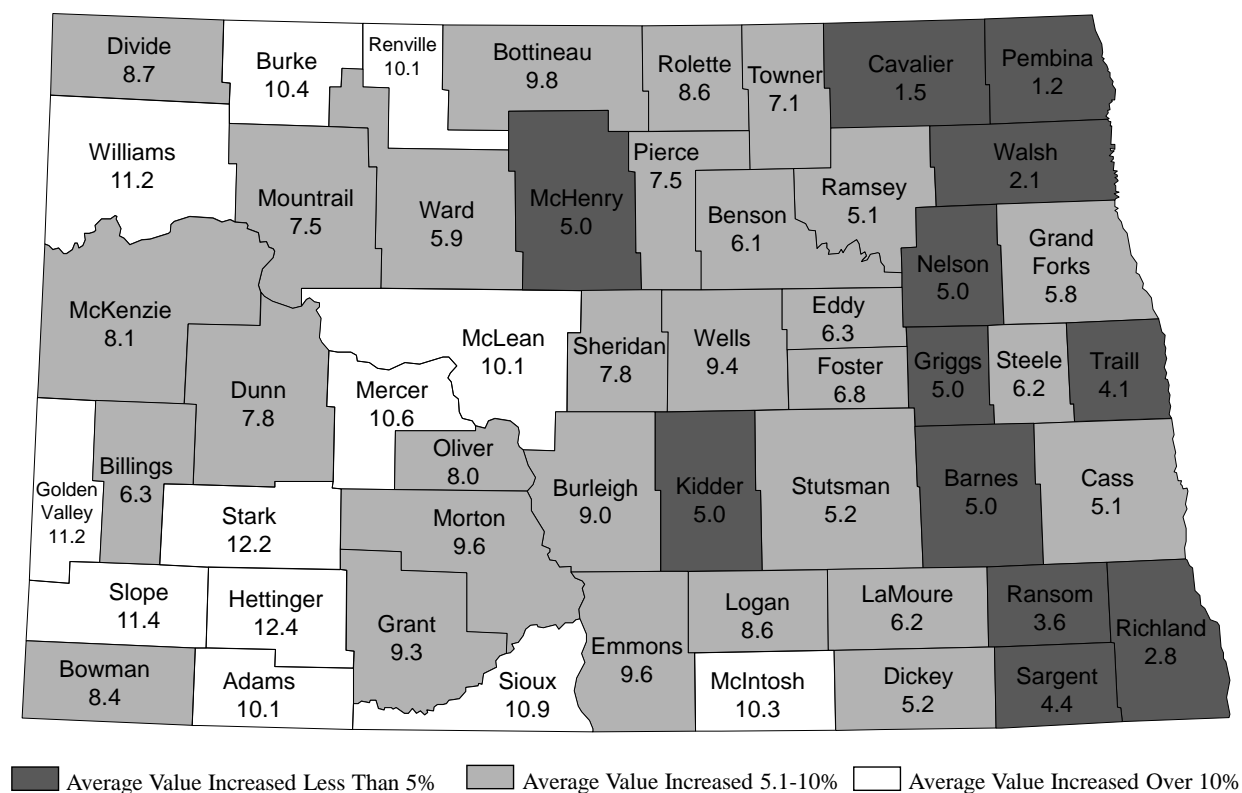


## RESULTS: CROPLAND VALUE

The average value of cropland in North Dakota increased by \$26.43 per acre, or 6.0 percent. The largest increases in average cropland value were 12.4 percent in Hettinger County and 12.2 percent in Stark County. Other counties with average cropland value increases greater than 10 percent included Adams, Burke, Golden Valley, McIntosh, McLean, Mercer, Renville, Sioux, Slope and Williams. Cropland values increased in all other counties by less than 10 percent. See Figure 3.

Changes in the capitalization rate and cost of production index impact all counties equally. The capitalization rate used for the 2011 analysis was the minimum value, 7.4 percent. The change in the capitalization rate increased values in all counties by 4.05 percent. The increase in the cost of production index resulted in a downward shift in land values in all counties of 5.72 percent from 2010. The net effect is that cropland values in all counties were down by 1.2 percent before any changes in productivity were included. Increased gross revenue due to increased yields and higher prices was the cause of increased cropland values calculated for 2011.

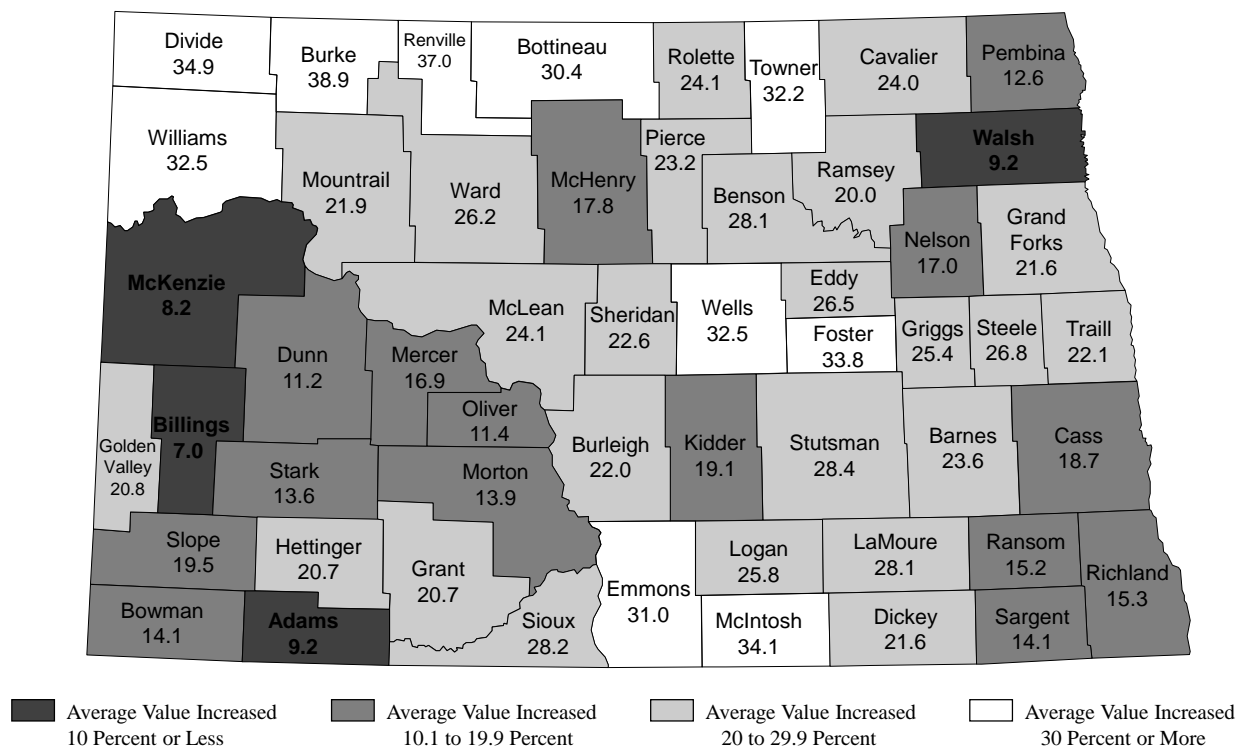
### Figure 3. Percent Change in Average Value of Cropland, 2010-2011



## Five-year Trend: Cropland Value

Cropland values have increased in all counties over the 2006-2011 period. The average value of North Dakota cropland was 23.4 percent higher in 2011 than in 2006. The rate of increase has been highly variable around the state as can be seen in Figure 4. Three counties in the southwest, Adams, Billings, and McKenzie, along with Walsh County in the northeast have 5-year increases of less than 10 percent. Cropland values increased by more than 10 percent in all other counties. The greatest increases were in McIntosh, Emmons, Wells, Foster, Towner, Bottineau, Renville, Burke, Williams, and Divide counties, all increasing by 30 percent or more.

**Figure 4. Percent Change in Average Value of Cropland, 2006-2011**



## **RESULTS: NON-CROPLAND VALUE**

The value of non-cropland (grazing land) decreased by 0.4 percent or \$0.42 per acre for the 2011 assessment. The value of non-cropland is derived by calculating the value of the beef produced from grazing. The carrying capacity and the production per cow are held constant in the model. As a result, all change in non-cropland value is due to changes in the price of calves and cull cows and changes in the capitalization rate and the cost of production index. All of these factors apply equally across all counties. Therefore all counties experienced the same percentage decrease in non-cropland values relative to 2010.

The price of calves and cull cows are used to determine the value of an animal unit month (AUM) of grazing. AUM is used as the measure of productivity of grazing land. Based on the price of calves and cull cows, an AUM had a value of \$65.03 for the 2009 marketing year, the most recent year added to the data set. This was down from \$67.56 the previous year. The value calculated for non-cropland, like cropland, is based on the average of the latest ten years after dropping the high and low years. Therefore, the average gross return is heavily influenced by the comparative values for the latest year added to the data set, relative to the year just removed from the data set. The average value per AUM for 1999, the year rolled out of the data set for this analysis, was \$55.25. As a result, the increase in value for non-cropland is a combination of an increase in the value of production, a decrease due to the increase in the cost of production index and the increase due to the lower capitalization rate.

### **Five-year Trend: Non-Cropland Value**

Non-cropland values increased 15.7 percent across the state from 2006 to 2011. All counties experienced the same change.

## **CAPITALIZED AVERAGE ANNUAL VALUES PER ACRE BY COUNTY**

Two tables are provided displaying county values for 2010 and 2011. North Dakota Capitalized Average Annual Values per Acre by County for 2010 are shown in Table 1. North Dakota Capitalized Average Annual Values per Acre by County for 2011 are shown in Table 2.

**Table 1. North Dakota Capitalized Average Annual Values Per Acre by County for 2010 Assessments**

<u>County</u>	<u>Cropland</u>	<u>Noncropland</u>	<u>All Agricultural Land</u>
Adams	222.95	92.93	173.63
Barnes	549.83	129.10	475.77
Benson	397.75	114.30	334.35
Billings	194.76	86.99	120.51
Bottineau	389.67	110.61	342.48
Bowman	238.42	76.77	158.87
Burke	324.93	101.71	257.32
Burleigh	300.46	102.03	210.82
Cass	680.89	131.27	665.52
Cavalier	530.79	112.18	472.96
Dickey	542.87	128.79	404.95
Divide	311.71	101.13	256.12
Dunn	237.19	92.69	146.74
Eddy	360.37	114.78	286.50
Emmons	375.89	101.04	260.09
Foster	468.69	110.49	404.09
Golden Valley	246.31	76.15	149.94
Grand Forks	624.72	128.85	582.21
Grant	243.89	93.17	166.80
Griggs	475.79	112.60	395.38
Hettinger	321.72	92.46	264.69
Kidder	310.14	103.04	218.74
LaMoure	562.19	133.19	505.73
Logan	335.61	101.67	222.96
McHenry	318.24	109.88	254.65
McIntosh	352.65	101.10	255.12
McKenzie	272.25	93.07	164.98
McLean	374.70	101.37	328.07
Mercer	266.83	92.64	191.40
Morton	268.47	92.86	166.91
Mountrail	324.53	100.99	231.22
Nelson	387.96	111.98	339.97
Oliver	316.11	93.14	186.19
Pembina	783.15	134.15	699.60
Pierce	340.67	109.90	291.31
Ramsey	400.58	115.14	348.17
Ransom	569.34	126.85	436.68
Renville	422.98	110.22	398.88
Richland	751.95	130.33	664.13
Rolette	360.98	111.80	318.11
Sargent	585.94	130.08	519.96
Sheridan	329.52	101.08	240.56
Sioux	236.57	92.94	122.75
Slope	279.99	84.69	179.61
Stark	267.49	93.35	202.75
Steele	610.43	114.41	541.99
Stutsman	445.93	127.23	345.25
Towner	414.69	114.82	401.32
Traill	744.87	130.08	697.65
Walsh	669.67	120.04	611.43
Ward	423.72	100.99	348.33
Wells	449.77	110.91	389.81
Williams	288.63	101.27	217.23
State	436.99	99.54	332.40

**Table 2. North Dakota Capitalized Average Annual Values Per Acre by County for 2011 Assessments**

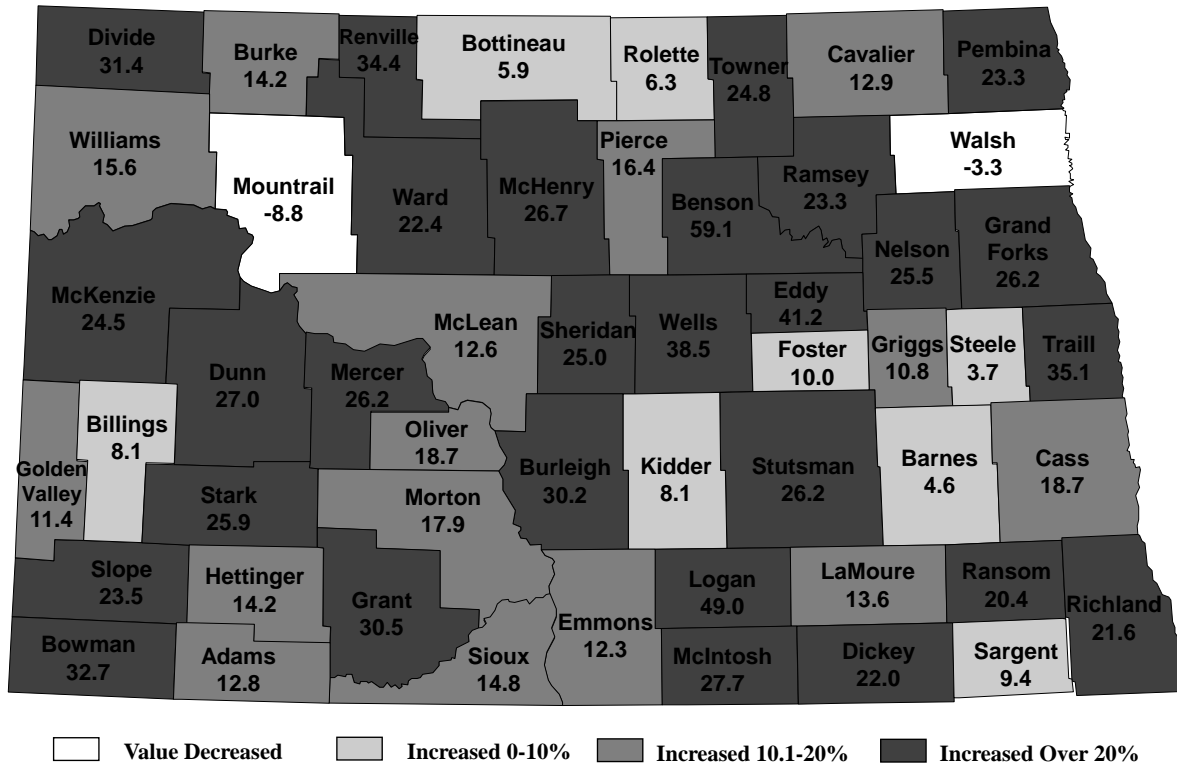
<u>County</u>	<u>Cropland</u>	<u>Noncropland</u>	<u>All Agricultural Land</u>
Adams	245.36	92.79	187.49
Barnes	577.42	128.91	498.61
Benson	422.14	114.13	353.47
Billings	206.97	86.86	124.22
Bottineau	427.74	110.45	374.41
Bowman	258.52	76.65	169.02
Burke	358.77	101.56	280.85
Burleigh	327.39	101.88	225.66
Cass	715.63	131.07	699.28
Cavalier	538.68	112.01	479.74
Dickey	570.92	128.60	423.59
Divide	338.75	100.98	275.98
Dunn	255.65	92.55	153.56
Eddy	383.24	114.62	302.49
Emmons	411.88	100.89	281.16
Foster	500.60	110.33	430.17
Golden Valley	273.99	76.04	161.88
Grand Forks	661.15	128.66	615.50
Grant	266.52	93.03	177.79
Griggs	499.41	112.43	413.72
Hettinger	361.75	92.33	294.78
Kidder	325.55	102.89	227.28
LaMoure	597.30	132.99	536.21
Logan	364.64	101.52	237.61
McHenry	334.06	109.72	265.59
McIntosh	389.06	100.95	277.44
McKenzie	294.33	92.94	173.77
McLean	412.66	101.22	359.52
Mercer	295.21	92.51	207.43
Morton	294.36	92.73	177.81
Mountrail	348.89	100.84	245.35
Nelson	407.49	111.82	356.11
Oliver	341.39	93.00	196.66
Pembina	792.73	133.95	707.92
Pierce	366.36	109.74	311.50
Ramsey	420.92	114.97	356.50
Ransom	589.95	126.66	451.10
Renville	465.52	110.06	438.14
Richland	773.08	130.14	682.22
Rolette	392.10	111.63	343.90
Sargent	611.56	129.89	541.84
Sheridan	355.28	100.94	256.34
Sioux	262.45	92.81	128.30
Slope	311.84	84.57	195.03
Stark	300.02	93.22	223.16
Steele	648.25	114.24	574.56
Stutsman	469.05	127.04	361.00
Towner	443.98	114.66	429.30
Traill	775.39	129.89	725.81
Walsh	683.61	119.86	623.88
Ward	448.91	100.84	367.39
Wells	492.17	110.74	424.61
Williams	321.05	101.12	237.35
State	463.42	99.12	350.37

## **MARKET VALUE OF NORTH DAKOTA FARM LAND**

The North Dakota Land Valuation Model was designed to estimate the value of agricultural land dependent solely on the revenue generated from the production of crops and beef cattle. The results of this model were not intended to reflect market value. Market value of farm land is influenced by numerous factors in addition to its productivity value. These include farm enlargement to gain economies of scale, land as an investment, recreational uses, development potential and the effect of government fiscal, monetary and tax policies. As a result, market value and productivity value often differ by a significant amount.

The North Dakota Agricultural Statistics Service conducts an annual survey of farmers and ranchers to obtain rental rates and the value of rented land. The data from the 2011 survey were compared with the 2010 survey for cropland and pasture. Changes in market values by county for cropland varied widely across the state. This survey showed values declined in 2011 in Mountrail County by 8.8 percent and in Walsh County by 3.3 percent. Values increased 10.0 percent or less in 8 counties, from 10.1 to 20.0 percent in 15 counties and over 20.0 percent in 28 counties. The largest increases were in Benson County at 59.1 percent, Logan County at 49 percent and Eddy County at 41.2 percent. Percentage changes in market value for cropland by county are shown in Figure 5.

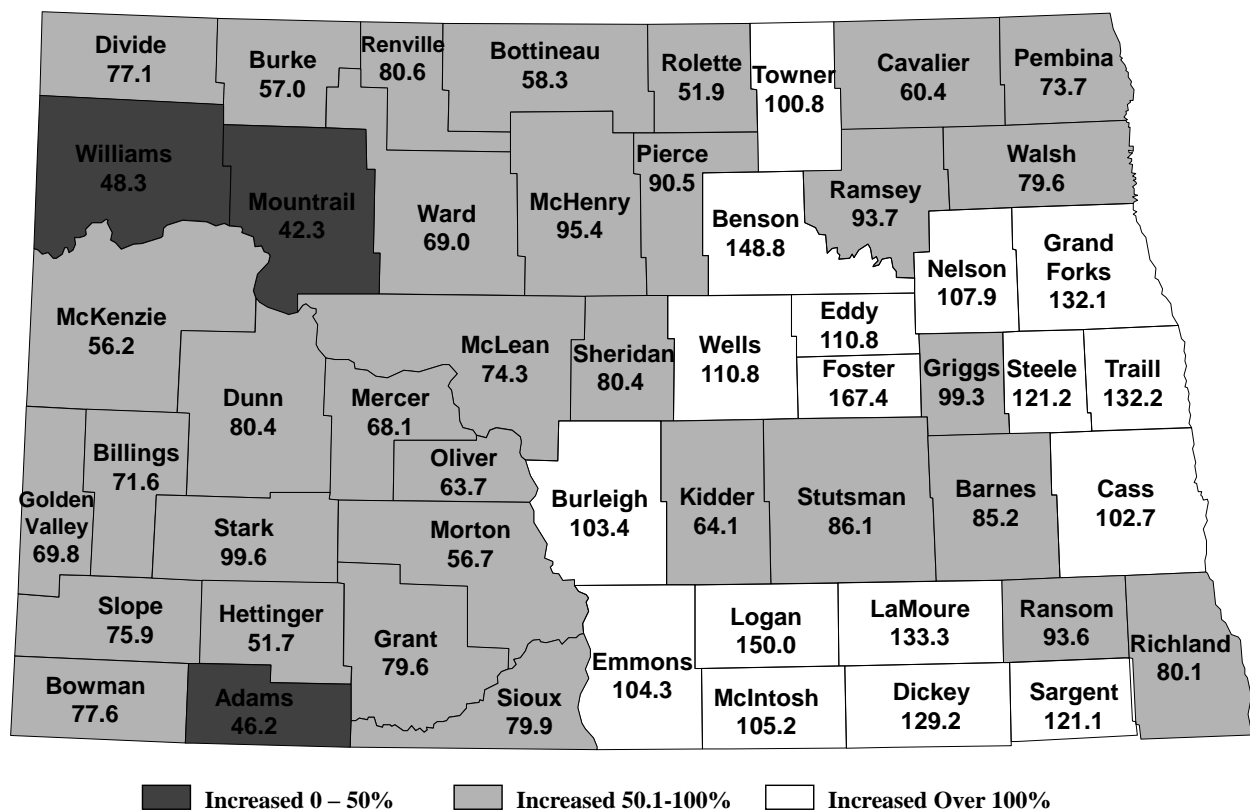
### Figure 5. Percent Change in Estimated Market Value of Cropland, 2010-2011



## Five-year Trend: Market Value of Cropland

The estimated market value of cropland reported by NASS has increased significantly more than the increase in productivity value over the 2006-2011 period. Foster County market value increased 167.4 percent, Logan County increased by 150.0 percent and Benson County by 148.8 percent. Other counties with increases of over 100 percent in market value were Towner, Grand Forks, Nelson, Wells, Eddy, Steele, Traill, Cass, Burleigh, Emmons, McIntosh, LaMoure, Dickey and Sargent. The majority of counties showed values had increased between 50.1 and 100 percent. Williams, Mountrail and Adams were the only counties to realize less than 50 percent increased value. Percentage changes in cropland market values are shown in Figure 6.

### Figure 6. Percentage Change in Estimated Market Value of Cropland, 2006-2011

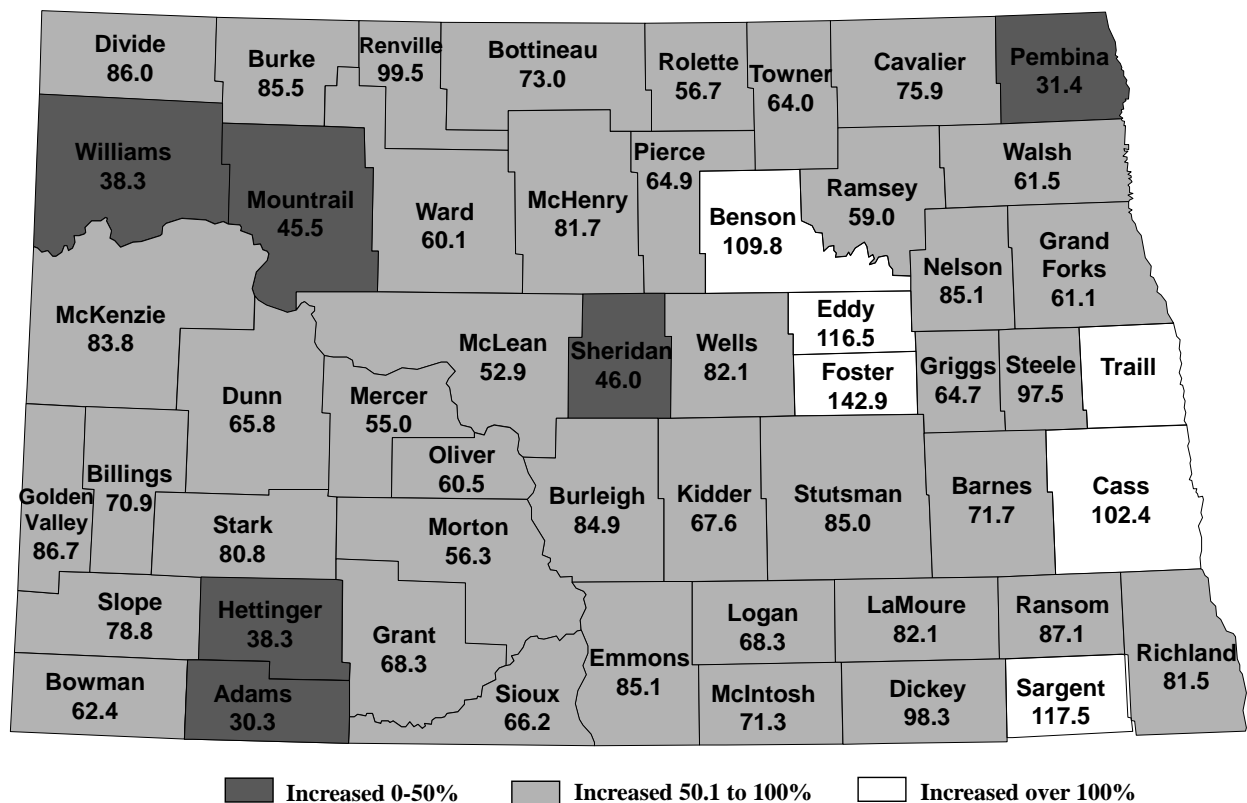




### Five-year Trend: Market Value of Pasture

Since 2006, market value estimates of pasture have shown considerable strength across most of the state. See Figure 8. The amount of increase was variable throughout the state. The greatest increase in market values occurred in Foster County at 142.9 percent, followed by Sargent County at 117.5 percent and Eddy County at 116.5 percent. Values increased between 50 and 100 percent in 41 counties and less than 50 percent in 6 counties. No value was provided for Traill County due to insufficient survey responses.

### Figure 8. Percentage Change in Estimated Market Value of Pasture, 2006-2011



## CONCLUSIONS

Valuation of all agricultural land in North Dakota, based on productivity, increased by 5.4 percent or \$17.97 per acre for the 2011 assessment as compared to the previous year. The average value of all agricultural land increased in all counties. The increases were greater than 10 percent in only Hettinger County at 11.4 percent and Stark County at 10.1 percent.

The average value of cropland in North Dakota increased by \$26.43 per acre or 6.0 percent. Non-cropland values for all counties decreased by 0.4 percent from the previous year. The production of grazing units is held constant for non-cropland, only the values per unit change from year to year. The price of cull cows and calves, cost of production index and the capitalization rate are applied uniformly across all counties. Therefore, the percentage change in non-cropland value is the same for all counties.

The increase in values for cropland and all agricultural land was due to the increased value of crop production. The value of production for most counties has been considerably higher since 2007 than prior years. This increase in value of production is a combination of increased yields, higher prices and a change in cropping mix. The change in crop revenue impacted land values from a negative 0.52 percent in Pembina County to an increase of 13.12 percent in Hettinger County. The capitalization rate change increased land valuations by 4.05 percent in all counties; while the cost of production index decreased land values in all counties by 5.72 percent.

The capitalization rate used for the 2011 analysis was the minimum value of 7.4 percent. The 2009 Legislature changed the minimum rate to 7.7 percent for 2010 and 7.4 percent for subsequent years. The calculated rate based on the formula was 6.25 percent.

The cost of production index increased by 7.9632 points over the previous year to 139.3382. The cost of production index reduced the landowner share of gross returns by 28.23 percent before this value was capitalized.

Changes in market value of cropland and pasture, based on the survey of farmers and ranchers by North Dakota Agricultural Statistics Service, is included for comparison. Market values increased considerably more than productivity values as estimated in the land valuation model. Market values also have shown more variability across the state. This is expected due to the additional factors that influence market values.

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