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**RESULTS OF THE NORTH DAKOTA
LAND VALUATION MODEL
FOR THE 2021
AGRICULTURAL REAL ESTATE ASSESSMENT**

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Table of Contents

	<u>Page</u>
List of Tables	iii
List of Figures	iii
Abstract	iv
North Dakota Land Valuation Model	1
Capitalization Rate	1
Cost of Production Index	2
Combined Effect	2
Results: All Agricultural Land Value	2
Comparison to Previous Year: All Agricultural Land Value	3
Five-Year Trend: All Agricultural Land Value	4
Results: Cropland Productivity Value	4
Comparison to Previous Year: Cropland Productivity Value	5
Five-Year Trend: Cropland Productivity Value	6
Results: Non-Cropland Productivity Value	7
Comparison to Previous Year: Non-Cropland Productivity Value	7
Five-Year Trend: Non-Cropland Productivity Value	7
Capitalized Average Annual Values per Acre by County	7
Market Value of Farmland in North Dakota	10
Comparison to Previous Year: Market Value Cropland	11
Five-Year Trend: Market Value of Cropland	12
Comparison to Previous Year: 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 Acres by County for 2020 Assessments	8
2. North Dakota Capitalized Average Annual Values Per Acres by County for 2021 Assessments	9

List of Figures

<u>Figure</u>	<u>Page</u>
1. Percent Change in Average Productivity Value of All Agricultural Land, 2020-2021	3
2. Percent Change in Average Productivity Value of All Agricultural Land, 2016-2021	4
3. Percent Change in Average Productivity Value of Cropland 2020-2021	5
4. Percent Change in Average Productivity Value of Cropland 2016-2021	6
5. Percent Change in Average Estimated Market Value of Cropland 2020-2021	11
6. Percent Change in Average Estimated Market Value of Cropland 2016-2021	12
7. Percent Change in Average Estimated Market Value of Pasture 2020-2021	13
8. Percent Change in Average Estimated Market Value of Pasture 2016-2021	14

ABSTRACT

This report summarizes the 2021 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 2021 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.

The average value per acre of all agricultural land in North Dakota increased by **0.10** percent from 2020 to 2021 based on the value of production. The formula cost of production index value used in the 2021 analysis was **219.85**. The formula capitalization rate was **4.31** percent. The capitalization rate had a larger effect on higher valuations compared to recent years.

Cropland value increased, on average, **0.12** percent. Across individual counties, the cropland valuation ranged from a decrease of 2.77 percent to an increase of 5.60 percent. County values had increases and decreases depending on crop mix and cropland to non-cropland percentages. Non-cropland values increased **0.59** percent. Generally, valuations for counties with a higher percentage of livestock increased partly due to higher returns for the newest year entering the data set compared to the oldest year of the data set which was replaced.

Changes in market value are included for comparison. Market value data are from the annual County Rents and Prices survey conducted by the North Dakota Department of Trust Lands.

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

RESULTS OF THE NORTH DAKOTA LAND VALUATION MODEL FOR THE 2021 AGRICULTURAL REAL ESTATE ASSESSMENT

Ronald Haugen¹

NORTH DAKOTA LAND VALUATION MODEL

North Dakota 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 calculated at 30 percent of gross returns for all crops except sugar beets and potatoes, 20 percent for sugar beets and potatoes, 25 percent for non-cropland and 50 percent of the dryland rate for irrigated land.

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 minimum rate was allowed to sunset after 2011.

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The capitalization rate was calculated based on the formula for the 2021 analysis. This rate was 4.31 percent. Lowering the capitalization rate from 4.36 percent for 2020 to 4.31 percent increases the values by **1.16** percent without any other changes. The interest rate for the latest year in the data set (2019) was 4.71%. This replaces the rate for 2007 which was 6.73%.

Cost of Production Index

Beginning with the analysis for the 1999 assessment, a cost of production index was incorporated into 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, Interest, Taxes and Wage Rates* from the *Prices Paid Index Annual Average* published by the USDA 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 index used for 2021 increased from 214.46 in 2020 to 219.85, for a one-year change of 5.39 points. This change in the cost of production index had the effect of reducing calculated land values by **2.51** percent from 2020.

The index value used in the 2021 analysis was 219.85, which resulted in a reduction in the landowner share of gross returns of 54.52 percent. The landowner share of gross returns is the amount that is capitalized to determine the land values. Therefore, land values are 54.52 percent lower than they would have been if the cost of production index were not included in the model.

Combined Effect

The cost of production index and the capitalization rate apply equally to all land in all counties. The net impact of the change in value from the previous year for these two factors was to decrease land values by **1.35** percent. Therefore, any change in county values more or less than a negative 1.35 percent from the 2020 values is due primarily to an increase or decrease in productivity. Values may also be impacted by a shift in the ratio between cropland and non-cropland acres.

RESULTS: ALL AGRICULTURAL LAND VALUE

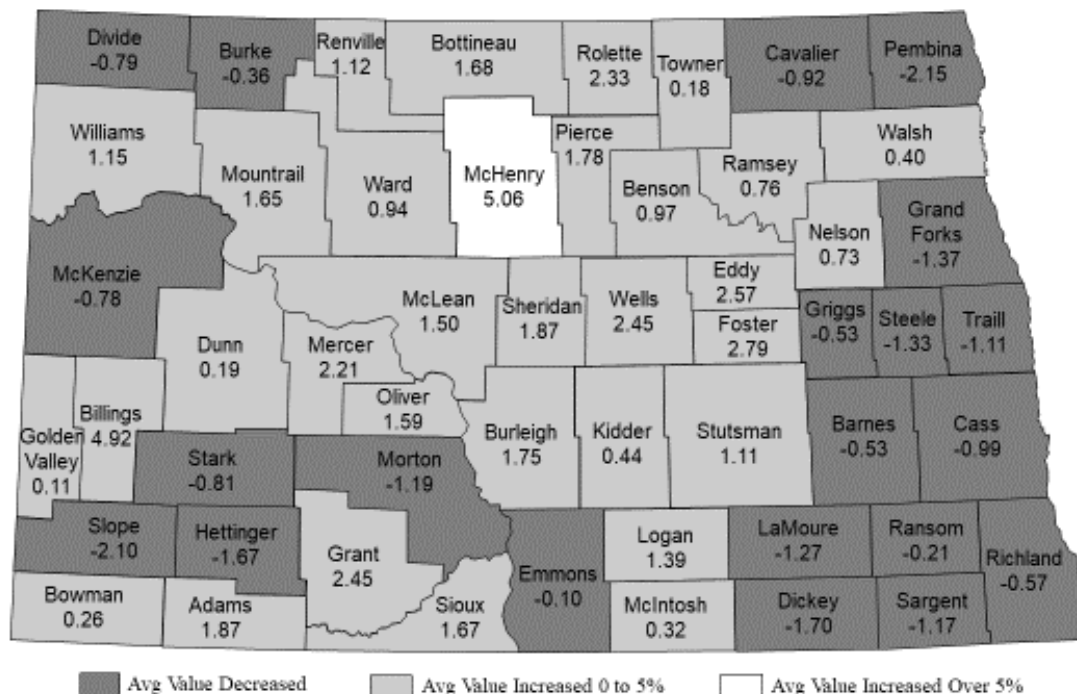
The value for all agricultural land is a weighted average of cropland and non-cropland in each county. Calculated values for cropland generally are three to five times the value of non-cropland in each county. Therefore, a shift in acres between these two categories will alter the “all land” value even 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 most years. 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.

Comparison to Previous Year: All Agricultural Land Value

Valuation of all agricultural land in North Dakota, for the 2021 assessment compared to the 2020 assessment increased by 0.10 percent or \$0.71 per acre over the previous year. This is the smallest statewide increase in recent years. The largest percentage increase occurred in McHenry County at 5.06 percent. The largest decrease was in Pembina County with a 2.15 percent decrease. Values decreased in twenty-one counties. Values increased from zero to 5 percent in thirty-one counties while values increased more than 5 percent in one county (McHenry). Results are shown in Figure 1.

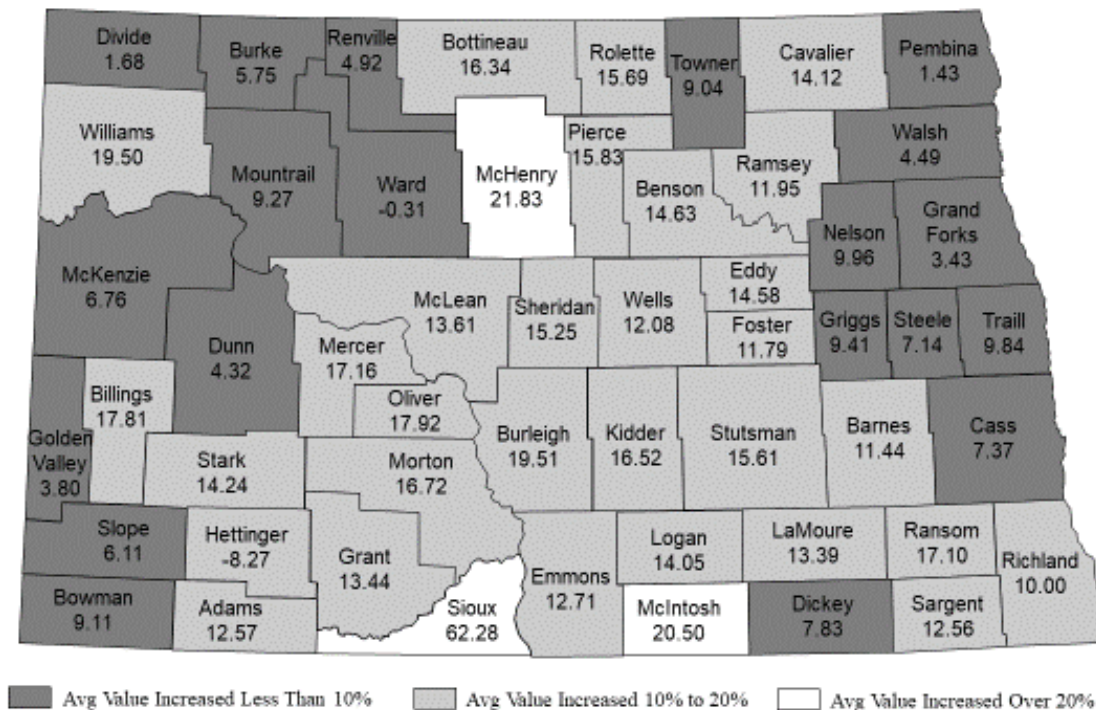
**Figure 1. Percent Change in Average Productivity
Value of All Agricultural Land, 2020-2021**



Five-Year Trend: All Agricultural Land Value

Estimated values for 2021 were compared with values estimated for 2016 to see how they have changed over time. The average value for all agricultural land in North Dakota increased 10.29 percent from 2016 to 2021, with a dollar value increase of \$63.13 per acre. The highest value increase was 62.28 percent in Sioux County partly due to a large acreage shift three years ago. Hettinger County had the largest decrease of 8.27 percent over this 5-year period. Twenty-one counties had decreases or increased less than 10 percent. Twenty-nine counties increased between 10 and 20 percent. Three counties increased more than 20 percent. The five-year percentage change in value per acre by county is shown in Figure 2.

Figure 2. Percent Change in Average Productivity Value of All Agricultural Land, 2016-2021



RESULTS: CROPLAND PRODUCTIVITY VALUE

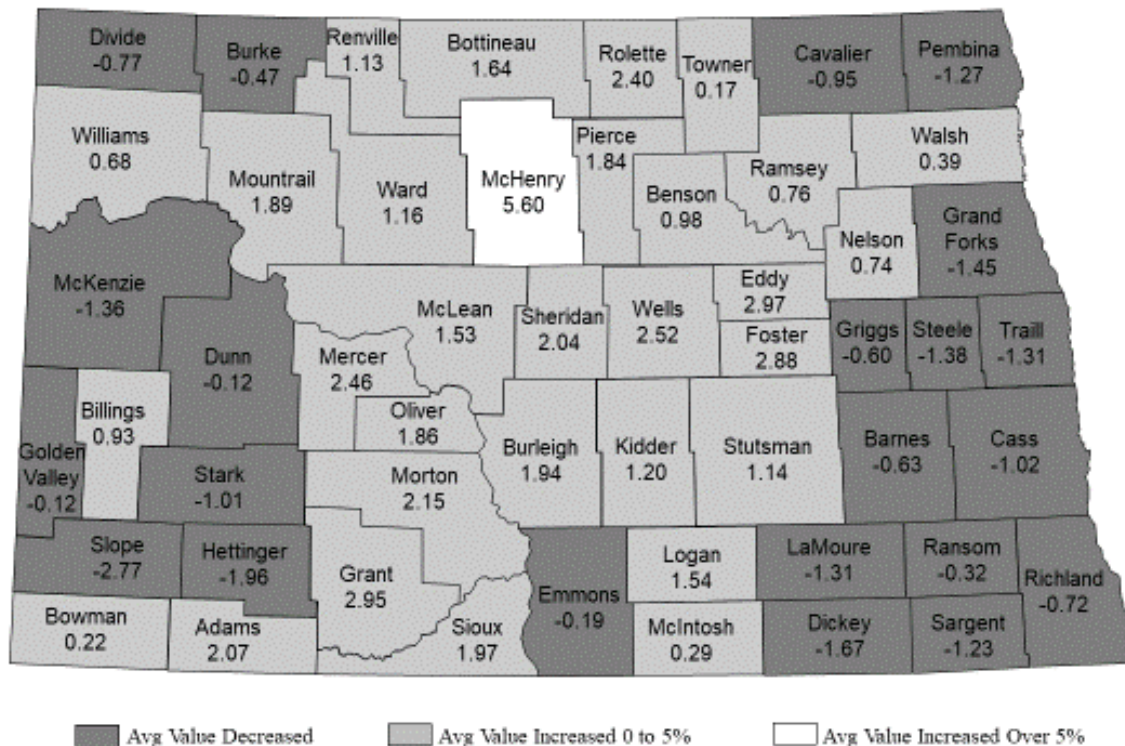
The value for cropland only applies to county acreages that are cropped for cash or feed crops, it does not include non-cropland acreages (pasture and rangeland). Changes in the capitalization rate and cost of production index impact all counties equally. The capitalization rate used for the

2021 analysis was 4.31 percent and the cost of production index used was 219.85 percent. The change in the capitalization rate increased values in all counties by 1.16 percent. The increase in the cost of production index resulted in a downward shift in land values in all counties of 2.51 percent from 2020. The net effect of these two components is that cropland values in all counties decreased by 1.35 percent before any changes in productivity were included. Therefore, increases and decreases in gross revenue were primarily due to crop yields, crop prices and crop mix.

Comparison to Previous Year: Cropland Productivity Value

The value of cropland increased an average of \$1.06 per acre across the state for 2021 compared to 2020. This was an average increase of 0.12 percent over 2020. This is the smallest statewide increase in the last ten years. McHenry County had the largest increase at 5.60 percent. Slope County had the largest decrease at 2.77 percent. Values decreased in twenty-two counties. Values increased from zero to 5 percent in thirty counties. Values increased more than 5 percent in one county (McHenry). The values are shown in Figure 3.

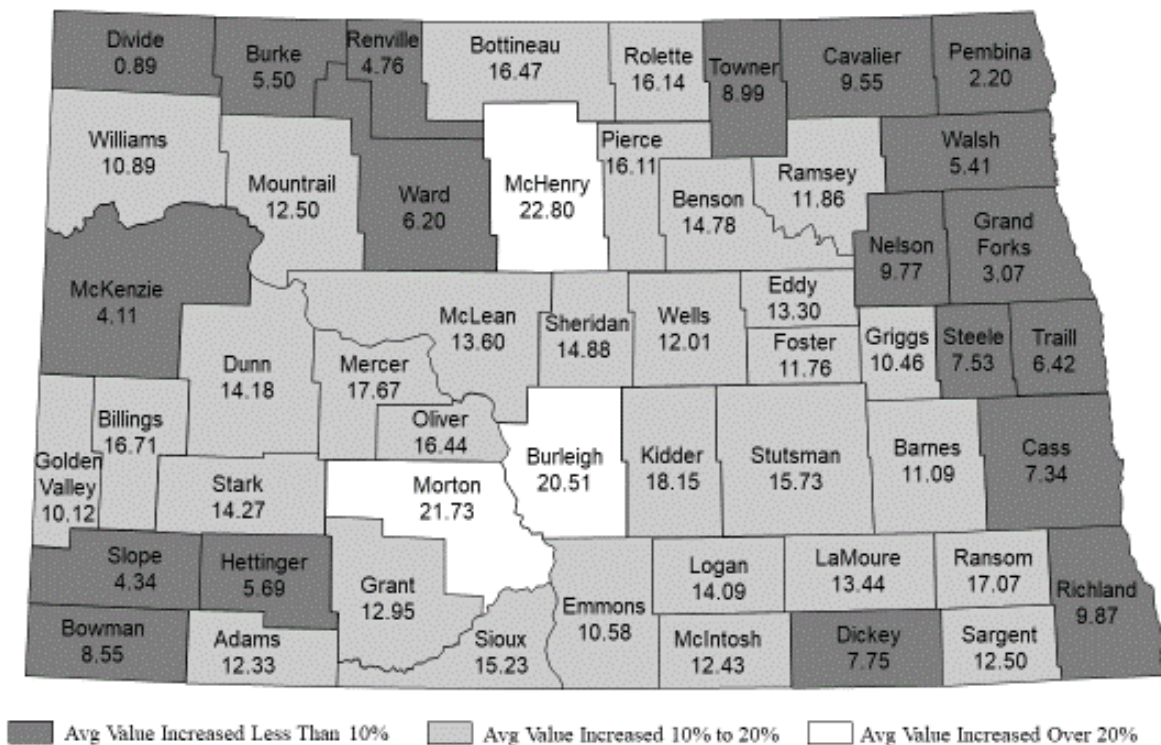
Figure 3. Percent Change in Average Productivity Value of Cropland, 2020-2021



Five-year Trend: Cropland Productivity Value

Cropland value based on the value of production has increased in all counties from 2016 to 2021. The average value of North Dakota cropland was 10.07 percent higher in 2021 than in 2016 with an increase of \$83.51 per acre. The largest increase was in McHenry County at 22.80 percent. The smallest increase in cropland value over this 5-year period was in Divide County at 0.89 percent. Nineteen counties increased less than 10 percent. Thirty-one counties increased between 10 and 20 percent. Three counties increased over 20 percent. The rate of increase has been highly variable across the state. The five-year trend percentages can be seen in Figure 4.

Figure 4. Percent Change in Average Productivity Value of Cropland, 2016-2021



RESULTS: NON-CROPLAND PRODUCTIVITY VALUE

The value of non-cropland (grazing land) based on the value of production increased by 0.59 percent or \$0.96 per acre from the 2020 to the 2021 assessment. The value of non-cropland is derived by calculating the value of the beef cattle 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, provided no acre changes were reported by the county. Therefore, all counties experienced the same percentage increase in non-cropland values relative to 2020.

Comparison to Previous Year: Non-Cropland Productivity Value

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 \$94.70 for the 2019 marketing year, the most recent year added to the data set. This is down from \$101.47 from the previous year. The AUM value used to determine productivity, is based on the average of the last ten years after dropping the high and low years. Therefore, the average gross return is 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 2009, the year rolled out of the data set for this analysis, was \$66.03. As a result, the increase in value for non-cropland is due to a combination of an increase in the value of production, an increase in the cost of production index (which causes a decrease in value) and a decrease in the capitalization rate.

Five-year Trend: Non-Cropland Value

Non-cropland values increased \$20.00 per acre from 2016 to the 2021 assessments. This is a 13.93 percent average increase for the state over this five-year period. All counties experienced the same change. Note that the 2014 data year (2016 assessments) was the high non-cropland year in all counties and was not used in the Olympic average the calculations.

CAPITALIZED AVERAGE ANNUAL VALUES PER ACRE BY COUNTY

Two tables are provided to display county values for 2020 and 2021. North Dakota Capitalized Average Annual Values per Acre by County for 2020 are shown in Table 1. North Dakota Capitalized Average Annual Values per Acre by County for 2021 are shown in Table 2.

Table 1. North Dakota Capitalized Average Annual Values Per Acres by County for 2020 Assessments

<u>County</u>	<u>Cropland</u>	<u>Non-cropland</u>	<u>All Agricultural Land</u>
Adams	563.30	151.83	407.16
Barnes	1,130.05	211.01	998.20
Benson	915.00	186.70	754.07
Billings	494.95	142.20	247.48
Bottineau	779.36	180.73	677.91
Bowman	544.04	125.46	389.45
Burke	655.96	166.28	504.59
Burleigh	768.35	166.74	495.33
Cass	1,354.13	214.45	1,290.83
Cavalier	1,056.42	183.26	973.40
Dickey	1,157.80	210.32	916.62
Divide	590.60	165.14	486.06
Dunn	599.31	151.38	291.28
Eddy	783.72	187.61	591.07
Emmons	944.72	165.14	629.38
Foster	1,000.23	180.50	853.37
Golden Valley	597.02	124.31	303.05
Grand Forks	1,210.09	210.55	1,035.06
Grant	594.27	152.29	369.16
Griggs	960.32	183.94	779.59
Hettinger	744.50	151.15	515.31
Kidder	652.29	168.35	369.03
LaMoure	1,275.00	217.66	1,135.34
Logan	786.01	166.06	486.69
McHenry	664.22	179.59	514.81
McIntosh	826.61	165.14	610.20
McKenzie	561.24	152.06	316.13
McLean	880.73	165.60	771.21
Mercer	698.39	151.38	461.51
Morton	748.62	151.83	404.34
Mountrail	733.49	164.91	481.34
Nelson	772.94	183.03	667.03
Oliver	794.95	152.29	424.08
Pembina	1,414.22	219.27	1,302.88
Pierce	816.06	179.59	674.46
Ramsey	867.89	188.07	705.47
Ransom	1,222.71	207.34	921.41
Renville	780.96	180.05	734.58
Richland	1,453.44	212.84	1,258.58
Rolette	787.39	182.57	690.50
Sargent	1,224.77	212.61	1,071.56
Sheridan	762.39	165.14	532.89
Sioux	601.15	151.83	352.36
Slope	644.27	138.30	377.11
Stark	682.80	152.52	484.81
Steele	1,276.83	186.93	1,120.83
Stutsman	1,028.44	207.80	799.16
Towner	869.95	187.61	837.42
Traill	1,483.49	212.61	1,432.66
Walsh	1,206.65	196.10	1,014.23
Ward	782.34	164.91	597.09
Wells	1,009.63	181.19	858.84
Williams	677.29	165.37	491.79
State	911.70	162.61	676.20

Table 2. North Dakota Capitalized Average Annual Values Per Acres by County for 2021 Assessments

<u>County</u>	<u>Cropland</u>	<u>Non-cropland</u>	<u>All Agricultural Land</u>
Adams	574.94	152.90	414.77
Barnes	1,122.97	212.30	992.94
Benson	924.00	187.94	761.39
Billings	499.54	142.92	259.65
Bottineau	792.11	181.90	689.33
Bowman	545.24	126.22	390.48
Burke	652.90	167.29	502.78
Burleigh	783.29	167.75	503.98
Cass	1,340.37	215.78	1,278.11
Cavalier	1,046.40	184.45	964.45
Dickey	1,138.52	211.83	901.08
Divide	586.08	166.36	482.20
Dunn	598.61	152.44	291.82
Eddy	806.96	188.63	606.24
Emmons	942.92	166.13	628.72
Foster	1,029.00	181.67	877.21
Golden Valley	596.29	125.29	303.38
Grand Forks	1,192.58	211.83	1,020.84
Grant	611.83	153.13	378.21
Griggs	954.52	185.15	775.43
Hettinger	729.93	151.97	506.68
Kidder	660.09	169.37	370.64
LaMoure	1,258.24	219.03	1,120.96
Logan	798.14	167.05	493.44
McHenry	701.39	180.74	540.88
McIntosh	829.00	166.13	612.14
McKenzie	553.60	153.13	313.65
McLean	894.20	166.59	782.77
Mercer	715.55	152.44	471.70
Morton	764.73	152.67	399.52
Mountrail	747.33	166.13	489.30
Nelson	778.65	184.22	671.93
Oliver	809.74	153.13	430.82
Pembina	1,396.29	220.65	1,274.88
Pierce	831.09	180.74	686.44
Ramsey	874.48	189.33	710.80
Ransom	1,218.79	208.58	919.44
Renville	789.79	181.21	742.82
Richland	1,442.92	214.39	1,251.46
Rolette	806.26	183.76	706.56
Sargent	1,209.74	213.92	1,058.99
Sheridan	777.96	166.13	542.87
Sioux	612.99	152.90	358.24
Slope	626.45	139.21	369.18
Stark	675.87	153.60	480.87
Steele	1,259.16	188.17	1,105.87
Stutsman	1,040.14	209.28	808.01
Towner	871.46	188.86	838.91
Traill	1,464.04	213.92	1,416.71
Walsh	1,211.37	197.45	1,018.31
Ward	791.42	166.13	602.69
Wells	1,035.03	182.37	879.86
Williams	681.90	166.59	497.45
State	912.76	163.57	676.91

MARKET VALUE OF FARMLAND IN NORTH DAKOTA

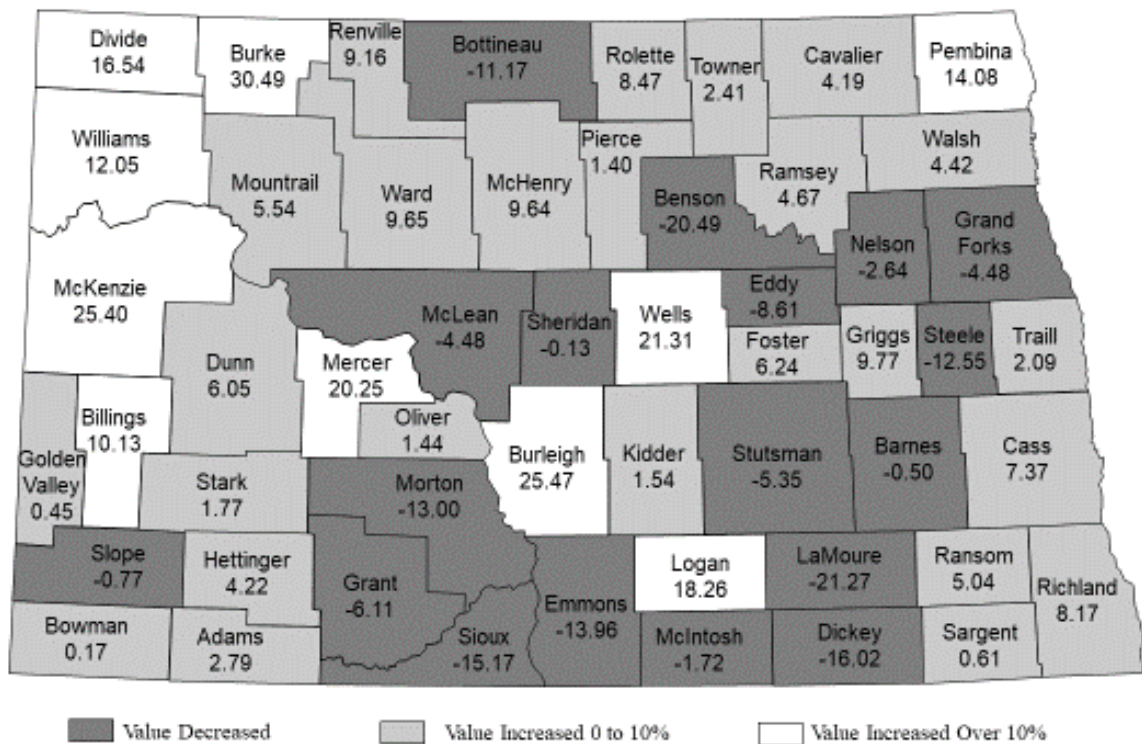
The North Dakota Land Valuation Model was designed to estimate the value of agricultural land depending solely on the revenue generated from the production of crops and beef cattle. The results of this model were not intended to reflect market value. Market value of farm land is influenced by numerous 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 Department of Trust Lands conducted the annual County Rents and Prices survey of farmers and ranchers to obtain rental rates and the price of rented land. The survey is done for cropland, pasture and hay land. This survey is available at: <https://land.nd.gov/>

Comparison to Previous Year: Market Value of Cropland

The data from the 2021 survey are compared with the 2020 survey for cropland. This survey showed values declined in eighteen counties while twenty-five counties increased from zero to 10 percent. Greater than 10 percent increases were reported in ten counties. At the opposite end of the price change spectrum were increases of 30.49 percent in Burke County, and a 21.27 percent decrease in LaMoure County. Percentage changes in market value for cropland by county are shown in Figure 5.

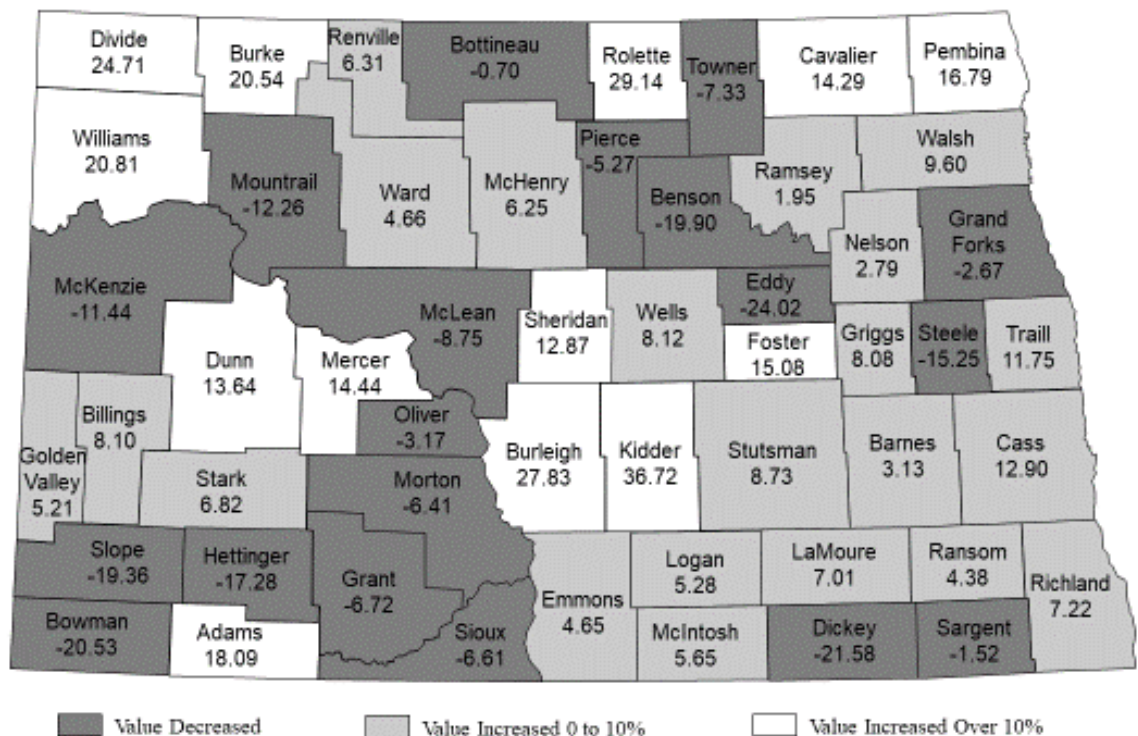
Figure 5. Percent Change in Estimated Market Value of Cropland, 2020-2021



Five-year Trend: Market Value of Cropland

The data from the 2021 survey are compared with the 2016 survey for cropland. Estimated market values decreased in twenty counties while nineteen counties increased from zero to 10 percent. Greater than 10 percent increases were reported in fourteen counties. At the opposite end of the price change spectrum were increases of 36.72 percent in Kidder County and a 24.02 percent decrease in Eddy County. Percentage changes in cropland market values by county are shown in Figure 6.

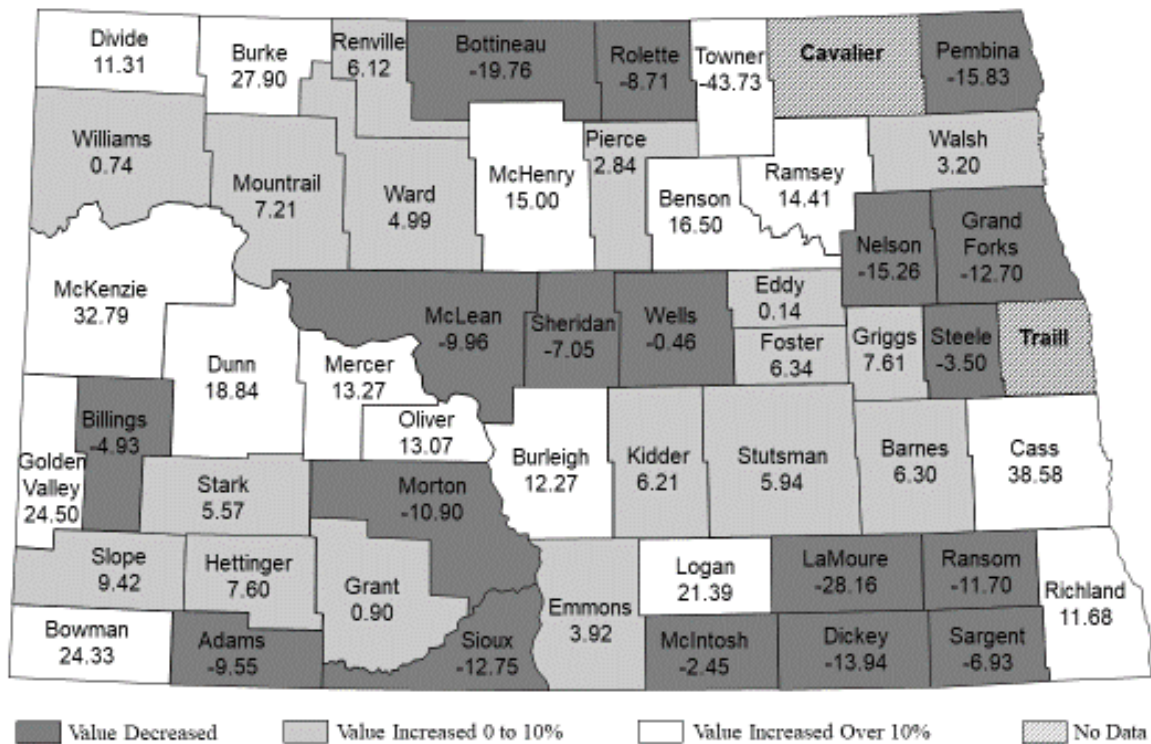
Figure 6. Percentage Change in Estimated Market Value of Cropland, 2016-2021



Comparison to Previous Year: Market Value of Pasture

The data from the 2021 survey are compared with the 2020 survey for pasture. This survey showed values declined in nineteen counties while seventeen counties increased from zero to 10 percent. Greater than 10 percent increases were reported in fifteen counties. There was insufficient data in two counties, so a percentage could not be calculated. At the opposite end of the price change spectrum were increases of 38.58 percent in Cass County, and a 43.73 percent decrease in Towner County. Percentage changes in the market value of pasture are shown in Figure 7.

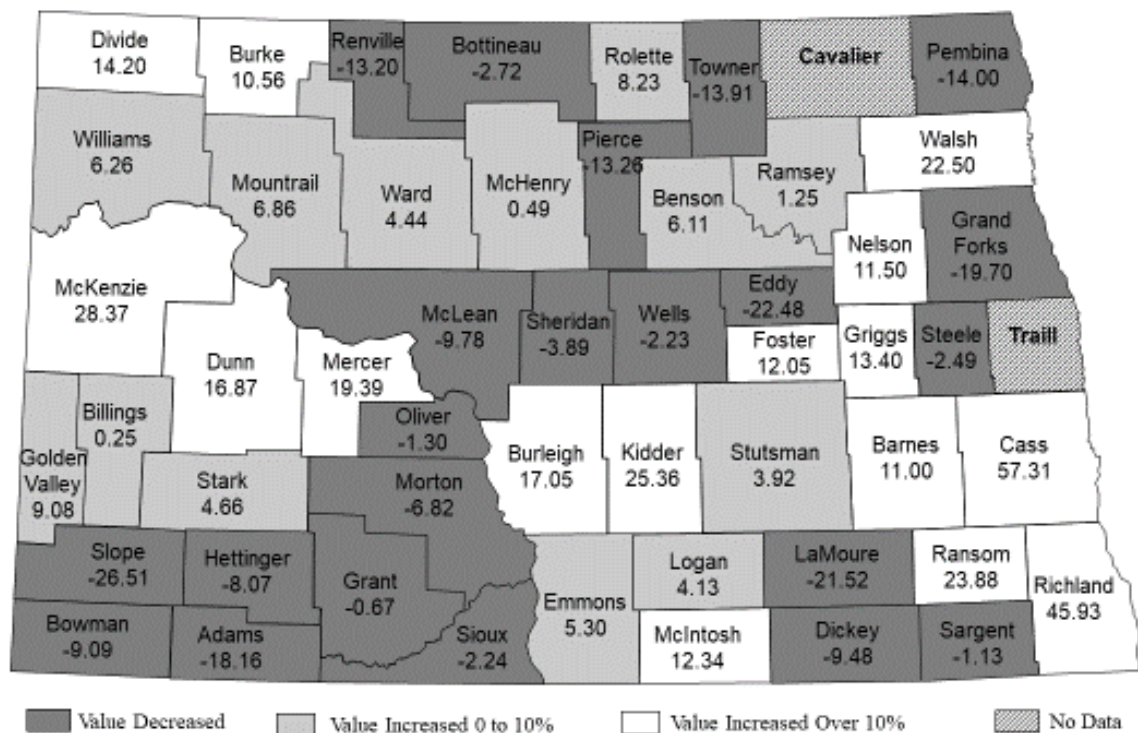
Figure 7. Percent Change in Estimated Market Value of Pasture, 2020-2021



Five-year Trend: Market Value of Pasture

The data from the 2021 survey are compared with the 2016 survey for pasture. Estimated market values decreased in twenty-two counties while thirteen counties increased from zero to 10 percent. Greater than 10 percent increases were reported in sixteen counties. There was insufficient data in two counties, so a percentage could not be calculated. At the opposite end of the price change spectrum were increases of 57.31 percent in Cass County, and a 26.51 percent decrease in Slope County. Percentage changes in the market value of pasture are shown in Figure 8.

Figure 8. Percentage Change in Estimated Market Value of Pasture, 2016-2021



CONCLUSIONS

The capitalization rate used for the 2021 analysis was the legislative formula rate of 4.31 percent down from 4.36 in 2020.

The cost of production index increased 5.39 points to 219.85 over the previous year of 214.46. The cost of production index reduced the landowner share of gross returns by 54.52 percent before this value was capitalized.

The analysis for 2021 added data from 2019 and dropped data from 2009. The crop revenue for most counties has been considerably higher since 2007 than prior years. Ten years of data are included in the analysis with the high and low years dropped to calculate an Olympic average. The decline in the capitalization rate resulted in an increase of 1.16 percent in values. This change was offset by the increase in the cost of production index. The cost of production index decreased values in all counties by 2.51 percent. This is a net 1.35 percent decrease from both these factors.

Valuation of all agricultural land in North Dakota, based on productivity, increased by 0.10 percent or \$0.17 per acre for the 2021 assessment as compared to the previous year. This is the smallest statewide increase in the last ten years. The average value was negative in twenty-one counties. The largest percentage increase occurred in McHenry County at 5.06 percent. The greatest decrease was Pembina County with a 2.15 percent decrease.

Valuation of cropland in North Dakota increased \$1.06 per acre. This was a 0.12 percent increase over 2020. The change in crop revenue and crop mix caused a change in cropland values from a negative 2.77 percent in Slope County to a positive 5.60 percent in McHenry County.

Non-cropland values for all counties increased by 0.59 percent or \$0.96 per acre 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.

Changes in market value of cropland and pasture, based on the survey of farmers and ranchers by the North Dakota Department of Trust Lands is included for comparison. Reported market values changed considerably more than productivity values from 2020 to 2021. However, market value changes were both negative and positive across the state. This is expected due to the additional factors that influence market values.

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