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2008 North Dakota Agricultural Outlook: Representative Farms, 2008-2017

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ABSTRACT

Net farm income for nearly all representative farms in 2017 is projected to be lower than in 2007. Low profit farms, which comprise 20% of the farms in the study, may not have financial resiliency to survive without off-farm income. Commodity prices are expected to fall from current levels, however, the final level is unknown. Two price level scenarios were analyzed. Commodity yields are projected to increase at historical trend-line rates and production expenses are expected to return to normal growth rates after 2009. Debt-to-asset ratios for all farms will decrease slightly throughout the forecast period. Debt-to-asset ratios for the low profit farms are expected to remain near the 0.50 level.

Keywords: net farm income, debt-to-asset ratios, cropland prices, land rental rates, farm operating expenses, capitalization rate, risk.

HIGHLIGHTS

Net farm income is projected to be lower in 2008 than 2007 for most farms, but much higher than the 2004-2006 average. The high prices received in 2007 are expected to be lower in the future, however 2008 prices may hold steady. Wheat prices, along with all commodity prices, are currently at all time highs. Less than favorable global production in 2007 along with upward price pressure from the corn sector has increased wheat prices to near $15 to $20 per bushel. Those levels are unsustainable in the longer run. Current and future prices are near the $8 to $9 range. Long term price projections vary widely depending on the source of the projections. For example, FAPRI projects wheat prices to settle near the $5.50 range and the USDA estimates wheat prices to be near $4.65 per bushel. The Global Wheat Policy Simulation Model projects wheat prices to be in the $7.30 range during the next few years. Because of price uncertainty two scenarios were developed, one using FAPRI's estimated prices and the other using prices developed from the GWPSM. FAPRI's estimated prices are lower than prices from the GWPSM.

Net farm income for the large size farm under the FAPRI scenario is predicted to decrease from $404 to $194 thousand over the 2007-2017 period. The net farm income is predicted to decrease from $142 to $88 thousand for the medium size farm and from $36 to $13 thousand for the small size farm. Net farm income is predicted to decrease from $563 to $231 thousand for the high profit farm and from $205 to $94 thousand for the average profit farm. Net farm income for the low profit farm is predicted to decrease from $15 thousand in 2007 to $3 thousand in 2017.

Net farm income for the large size farm under the GWPSM is predicted to decrease from $404 to $317 thousand over the 2007-2017 period. The net farm income is predicted to increase from $142 to $160 thousand for the medium size farm and from $36 to $38 thousand for the small size farm. Net farm income is predicted to decrease from $563 to $338 thousand for the high profit farm and from $205 to $139 thousand for the average profit farm. Net farm income for the low profit farm is predicted to decrease from $15 thousand in 2007 to $6 thousand in 2017.

Debt-to-asset ratios for most representative farms are predicted to decrease slightly throughout the forecast period. Debt-to-asset ratios are projected to decrease 1% for the large-size representative farm, 7% for the medium size representative farm, and 5% for the small size representative farm by 2017. The ratios are also projected to decrease 27% and 30% for the high and average profit representative farms by 2017, respectively. The debt-to-asset ratio for the low profit farm is projected to decrease 1%.

For the average profit representative farm, state average cropland values will increase 6.2%, from $842 per acre in 2007 to $894 per acre in 2017. Cash rents will increase 6.2%, from $44.68 per acre in 2007 to $47.47 per acre in 2017. Cropland values and rent are estimated solely on returns to cropland and not the recent market run-up. The average price of cropland in North Dakota was $565 per acre in 2004. It increased 4.2% to $589 per acre in 2005. Land price was $592 per acre in 2006 and $842 per acre in 2007, a 42% increase in one year. Land cost is only one part of operating expense. Overall operating expense increased by 51% since 2004 because of higher fertilizer, fuel, chemicals, and land costs and those costs will continue into the future.

2008 North Dakota Agricultural Outlook: Representative Farms, 2008-2017

Richard D. Taylor, Won W. Koo, and Andrew L. Swenson*

INTRODUCTION

North Dakota represents a major agricultural area with distinctive climate and crop mix. The state is uniquely situated in terms of marketing and logistics within the United States because it shares a border with Canada, which is the United States' largest trading partner. Changes in government policies through recent farm bills and the Uruguay Round Agreement (URA) have affected the region's economy. The recent changes in Federal policy towards renewable energy has increased corn ethanol production along with commodity prices in general.

The main objective of this analysis is to evaluate changes in net farm income and debt-to-asset ratios for different size and profit categories of representative farms. The representative farms are developed from the North Dakota Farm and Ranch Business Management Education Program farm records and are projected over the 2008 to 2017 period under the Farm Security and Rural Investment Act (FSRIA) of 2002, the URA, and the North American Free Trade Agreement (NAFTA). The Food, Conservation, and Energy Act of 2008 had not become law when this analysis was completed. Secondary objectives are to evaluate the reaction of cropland prices and cash rental rates to the farm income estimates over the same time horizon. The risk analysis was not conducted this year because current commodity prices are above any historical level.

The North Dakota agricultural outlook for the 2008-2017 period is based on the baseline results produced by the Food and Agricultural Policy Research Institute (FAPRI) global model and the North Dakota Global Wheat Policy Simulation Model.

U.S. agriculture has been influenced by major changes in agricultural and trade policies. Trade agreements, such as CUSTA, the North American Free Trade Agreement (NAFTA), and the URA, have liberalized agricultural trade and will continue to do so for the next decade.

DEVELOPMENT OF AN EMPIRICAL MODEL

Major crops produced in North Dakota are hard red spring wheat, durum wheat, barley (malting and feed), corn, soybeans, and minor oilseeds, including sunflower and canola. In addition, the region produces dry edible beans, flax, field peas, sugarbeets, and potatoes. The agricultural sector provides between 5% and 10% of the state economy. The average farm size in North Dakota is 1,313 acres including pasture. About 43% of total farms in North Dakota have a

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farm size less than 1,000 crop acres. In addition, small farms (less than 200 acres) account for 26% of total farms in North Dakota but only 3% of total farmland.

The North Dakota Representative Farm Model is a stochastic simulation model designed to analyze the impact of policy changes on farm income. The model projects average net farm incomes, debt-to-asset ratios, cash rents, and cropland prices for representative farms producing five major crops: wheat, barley, corn, soybeans, and sunflowers. The model is linked to the FAPRI and North Dakota econometric simulation models, and it uses the prices of the crops generated from these models (Figure 1). The base model assumes an average trend yield based on historical data and average predicted prices received by farmers based on the historical relationships between FAPRI prices and North Dakota prices. In addition, macro policies and assumptions, trade policies, and agricultural policies are incorporated into the model directly or indirectly by the assumptions made by FAPRI in their price series. For the outlook, policies are assumed to remain constant.

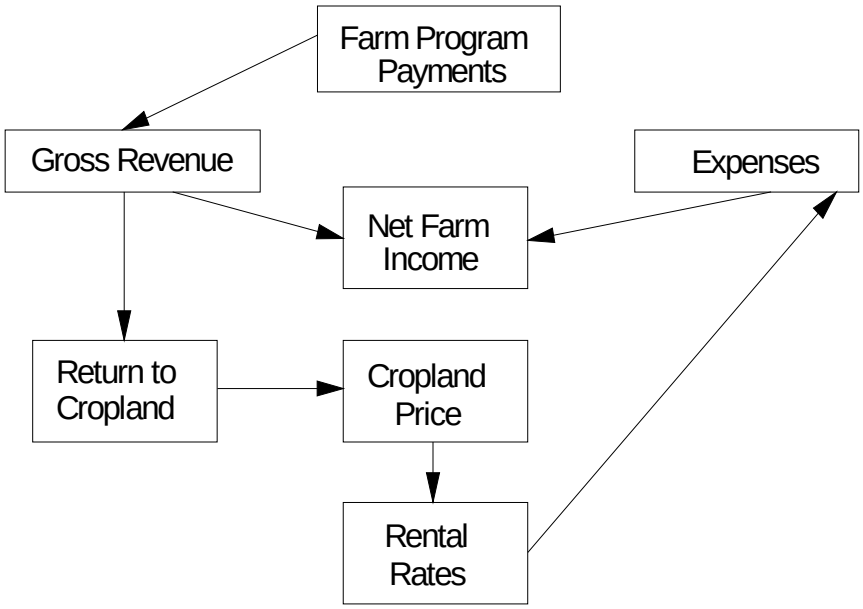
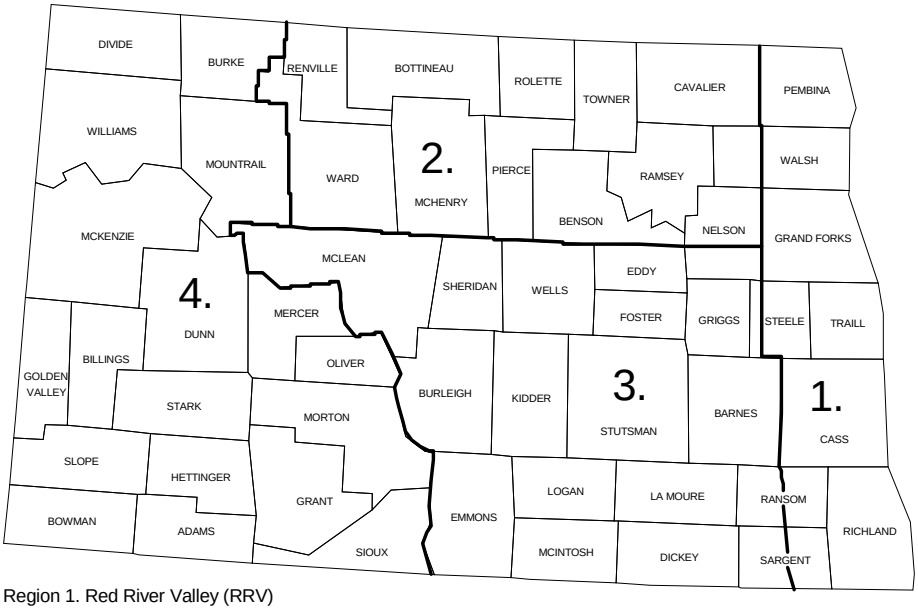


Figure 1. Structure of the North Dakota Representative Farm Model

Alternative farm policies affect net farm income for the representative farms. Changes in return to cropland, given the market-determined capitalization rate, result in changes in land prices. Changes in return to cropland affect cash rental rates that farmers are willing to pay on land used to produce crops. Changes in land price and cash rental rates in turn affect net farm income through adjustments in farm expenses. These changes affect the debt-to-asset ratios of the representative farms.

The North Dakota Representative Farm

The model has 24 representative farms: six farms in each of the four regions of North Dakota. These regions are the Red River Valley (RRV), North Central (NC), South Central (SC), and Western (West) (Figure 2). The farms in each region are representative of the average, high, and low profit farms and small, medium, and large size farms enrolled in the North Dakota Farm and Ranch Business Management Education Program.



Region 1. Red River Valley (RRV)
Region 2. North Central (NC)
Region 3. South Central (SC)
Region 4. Western (West)

Figure 2. North Dakota Farm and Ranch Business Management Regions

The representative farms average 1,819 acres of cropland and 635 acres of pasture. The farms are about 83% larger than the state average reported by the North Dakota Agricultural Statistics Service. A reason for this difference is that the state average includes all farms with $1,000 or more in sales; therefore, hobby farms, farms operated as part of combined larger farms, semi-retired farms, and commercial farms are all included, while the farms used in this study mainly represent commercial farms.

The average representative farm is an average of all farms in the Farm and Ranch Business Management Records System for the state in each production region. The high profit representative farm is an average of farms in the top 20% of farm profitability for each production region. The low profit representative farm is an average of farms in the bottom 20% of farm profitability in each production region. Average farm sizes are 3,581 cropland acres for the high profit farms, 1,819 cropland acres for the average profit farms, and 690 cropland acres

for the low profit farms. In addition, the high, average, and low profit farms had 1,040, 715, and 366 acres of pasture, respectively. The profit farms include some RRV farms located in Minnesota.

The large representative farm is the average of the largest 25% of farms in cropland acres for each producing region. The small representative farm is an average of the smallest 25% of the farms for each producing region. Average farm sizes are 3,627 cropland acres for the large size farms, 1,476 cropland acres for the medium size farms, and 465 cropland acres for the small size farms (Table 1). In addition, the large, medium, and small size farms had 729, 630, and 718 acres of pasture, respectively. The size farms include only farms located North Dakota.

Table 1. Characteristics of Representative North Dakota Farms, 2007

	Size			Profit		
	Large	Medium	Small	High	Average	Low
Number of Farms	133	265	133	128	641	128
Total Cropland (ac)	3,627	1,476	465	3,581	1,819	690
Spring Wheat (ac)	1,046	352	76	1,272	602	159
Durum Wheat (ac)	101	38	6	111	51	4
Barley (ac)	189	81	11	261	135	45
Corn (ac)	313	154	59	137	87	65
Sunflower (ac)	168	55	9	371	138	10
Soybeans (ac)	484	174	33	428	228	96

Figure 3 shows the historical average farm expense and profit for the farms in the North Dakota Farm and Ranch Management Program located in the NC, SC, and West regions of the state during the past 10 years, excluding the RRV. In 1994, the farms averaged $171,713 gross income with a profit of $46,289. In 2007, the farms averaged $558,843 gross return with a profit of $163,936. In 1994, the farms generated $1.37 gross output for every $1 in inputs; by 2006, that had fallen to $1.22 gross output for every $1 in inputs. Figure 4 shows the average size of the farms. In 1994, the average size was 1,262 acres. In 2007, the average size was 1,819 acres. This is an increase of 44% over the 13-year period. Net return per acre fell from $36.67 per acre in 1994 to $33.20 per acre in 2005 before increasing to $88.97 in 2007. Operating expenses has increased 105% since 1994 and 51% since 2004.

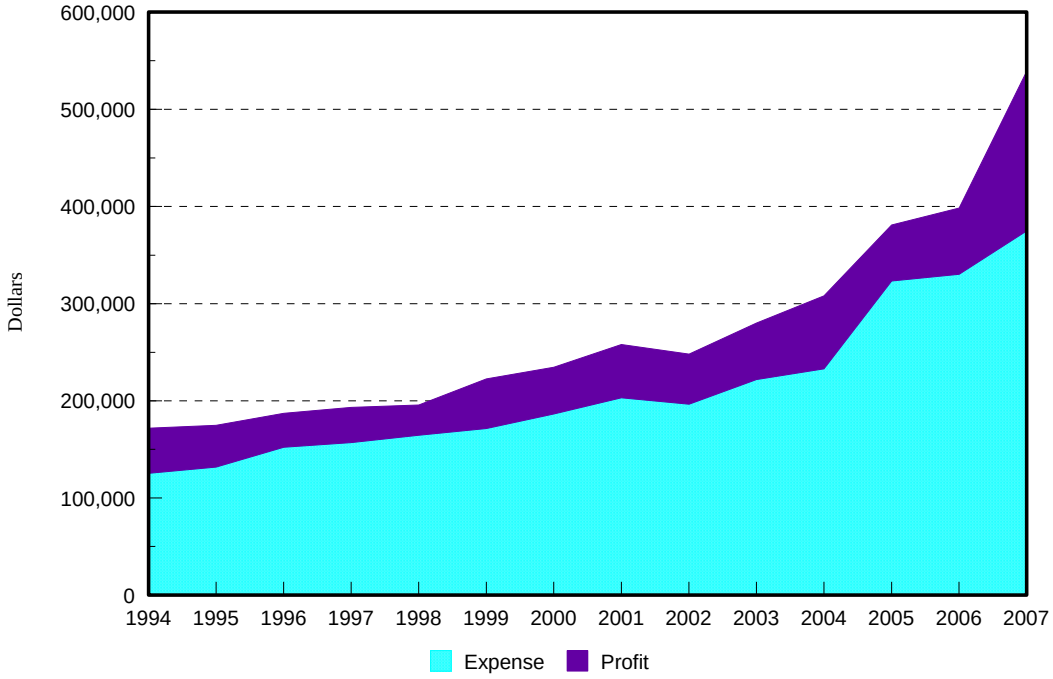


Figure 3. Average Expense and Profit for Farms Excluding the Red River Valley, In the North Dakota Farm and Ranch Business Management Program

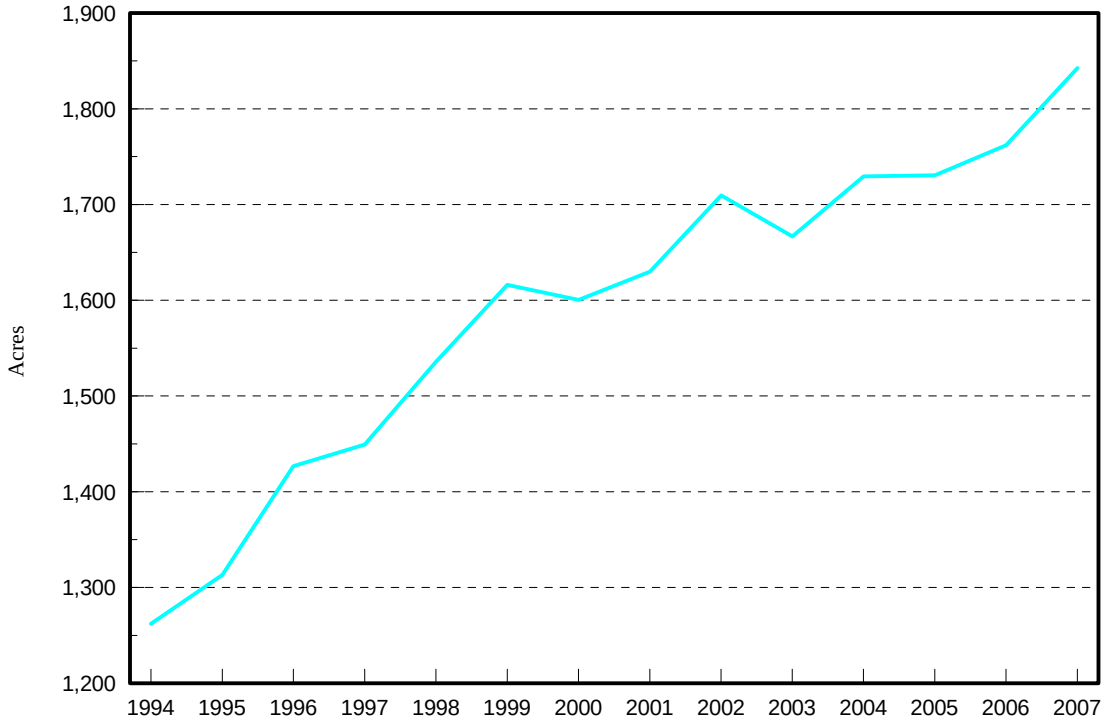


Figure 4. Average Cropland Acres of Farms in the North Dakota Farm and Ranch Management Program

Figure 5 shows the distribution of per acre gross returns for farms within the Farm and Ranch Business Management program for 2007. The majority of the returns are in the $160 to $280 per acre. Many of the farms in the lower distribution are farms in the West region where livestock is the major enterprise and farms in the upper distribution are RRV farms with sugarbeets. The average gross returns for 2007 is $249 per acre, which is higher than any of the previous years. In 2006, the majority of farms had gross returns between $100,000 and $160,000. Table 2 shows the average per acre gross returns to cropland and net farm income for 2000 to 2007. Per acre gross returns has increased from $67 in 2000 to $138 in 2006 while net farm income has stayed in the $59,000-60,000 range for those two years. In 2007, net farm income increased to about $199,200 because of higher commodity prices. There are numerous factors involved in net farm income other than crop returns. Returns to livestock are a major factor in the western portion of the state along with government payments and proceeds from crop insurance. Expenses have also increased substantially during the past seven years which put downward pressure on net farm income.

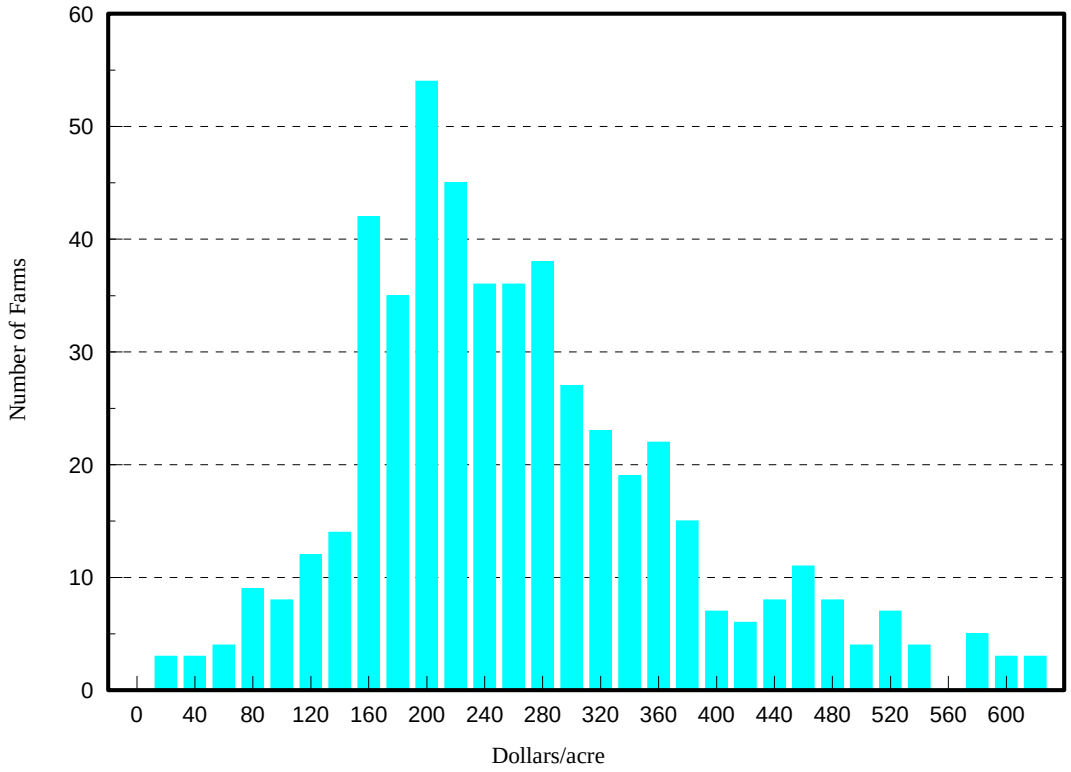


Figure 5. Distribution of Gross Returns per Acre of Cropland for 2007

Table 2. Average Per Acre Gross Returns and Net Farm Income For Farms in the North Dakota Farm and Ranch Business Management Program

	Per Acre Gross Returns	Net Farm Income
	Dollars per acre	Dollars
2000	67	68,800
2001	78	44,400
2002	101	59,100
2003	114	76,400
2004	119	66,800
2005	119	57,500
2006	138	68,200
2007	249	199,200

Structure of the Representative Farm Model

The model consists of four components: net farm income, debt-to-asset ratio, land price, and cash rent. This section discusses the definition of each component and the formulas used to calculate them.

Net Farm Income.

Net farm income is calculated by subtracting total crop and livestock expenses from total farm income. Crop and livestock expenses consist of direct costs that include seed, fertilizer, fuel, repairs, feed, supplies, feeder livestock purchases, and hired labor; and indirect costs that include machinery depreciation, overhead such as insurance and licenses, land taxes, and land rent or interest on real estate debt. Total farm income is the sum of cash receipts from crop and livestock enterprises, government payments, CRP payments, custom work, patronage dividends, insurance income, and miscellaneous income. Net farm income is calculated as:

$$NFI = \sum Y_j P_j A_j + \sum P_h L_h + \sum S_j A_j + I^o - \sum EX_h^L - \sum EX_j^C \quad (1)$$

where

Y_j = yield per acre for crop j,
P_j = price of crop j,
A_j = planted acres of crop j,
P_h = price of livestock h,
L_h = number of livestock h sold,
S_j = government subsidies for crop j per acre,
I^o = other farm income,
EX^C_j = total expenses in producing crop j,
EX^L_h = total expenses in producing livestock h.

Inventory changes, accounts receivable, accounts payable, and prepaid expenses and supplies are assumed to be constant from year to year. Cash receipts are based on predicted cash prices and yields in North Dakota. Cash prices received by farmers are based on national price projection by FAPRI, adjusted to North Dakota. The adjustments are estimated from North Dakota price equations which were calculated on the basis of the historical relationships between North Dakota prices and U.S. export prices of the commodities. Annual data from 1974 to 2006 were used to estimate price equations. The price equations were used to estimate cash prices received by North Dakota farmers for the 2008-2017 period. The FAPRI prices are used as exogenous variables in the price estimates.

Regional North Dakota yield trend equations were estimated from historical yield data reported by the North Dakota Agricultural Statistics Service from 1974 to 2006. The estimated equations were used to forecast crop yield trends for future years. A dummy variable was used to compensate for two drought years: 1980 and 1988.

Debt-to-asset Ratio.

The debt-to-asset ratio is calculated by dividing total outstanding farm debt by total farm assets. Total debt includes debt on land, intermediate debt, and short-term debt. Total assets include price of farmland times acres of farmland owned and the depreciated value of farm equipment and supplies, livestock, and liquid assets. The value of farm equipment, supplies, and livestock is assumed to be constant over the forecast period.

Cropland Prices and Cash Rent.

Land prices for representative farms are estimated on the basis of the implicit discount rate the farms have previously used and the expected return on land. Therefore, land prices are defined as the amount that farms can afford to pay for farmland. They are not prevailing market prices. Financial data from average representative farms for each region are used to calculate a dollar return to land. To do this, all production expenses for the crops, including depreciation, land taxes, a labor charge for unpaid family labor, net return from a livestock enterprise, and a management fee equivalent to that charged by bank trust departments for management of share-rented farms, are subtracted from gross farm income. To the remaining balance, interest on real estate debt is added back because the return to land is not affected by ownership of the land. This figure is used as the return allocated to cropland.

The average return allocated to each acre of cropland per year is divided by the average cropland price to determine the long-run capitalization rate used by farmers, as follows:

$$R_g = \frac{M_g}{PL_g} \tag{2}$$

where

R_g = long-run capitalization rate in region g,
M_g = average net return allocated to cropland in region g,
PL_g = average observed price of cropland in region g.

For the forecast years, this capitalization rate is applied to the estimated average income per acre allocated to cropland to determine cropland value for land utilized to produce wheat, corn, soybeans, barley, and sunflowers. The average income is an n-year weighted moving average of annual per acre income. Calculation of cropland prices is summarized as

$$PL_{gT}=\frac{1}{R}\sum_{t=T-n}^{t} W_t M_{tg}+T_r \qquad (3)$$

where

PL_{gT} = cropland price in region g in time t,
W_t = weighting factor for year t,
M_{tg} = net return allocated to cropland in region g and year t,
T_r = trend.

The price of cropland calculated in Equation 3 can be defined as the amount farmers are willing to pay for the cropland to produce wheat, barley, corn, soybeans, and sunflowers.

Cash Rent.

Cash rent for cropland is calculated by multiplying a k-year moving average of estimated price of cropland by the long-run capitalization rate, plus taxes on land. Calculation of cash rent is summarized by

$$CR_{gT}= \sum EM_{gt}R_g+TX_T \qquad (4)$$

CR_{gT} = cropland cash rent in region g in time T,
EM_{gt} = estimated price of cropland in region g and year t,
TX_T = taxes on land in time T.

The cash rent is defined as the amount farmers are willing to pay for the rented cropland to produce wheat, barley, corn, soybeans, and sunflowers.

DATA USED FOR THE REPRESENTATIVE FARM

The commodity prices for crops are obtained from the FAPRI and ND Global Wheat Policy simulation models. The national average farm prices are converted to the prices received by North Dakota representative farms by regressing average farm price of each crop produced in North Dakota against the national average farm price of the same crop. The price equation used for this study is specified in a dynamic framework on the basis of Nerlove's partial adjustment hypothesis, as follows:

$$P_{it} = a_0 + a_1 P_t + a_2 P_{it-1} + e_{it} \qquad (6)$$

where P_{it} = average farm price of a crop in region i in time t,
P_t = national average farm price of a crop in time t.

The price equation is estimated for each crop produced in North Dakota using the time series data from 1975 to 2006. The estimated equations are used to predict average prices received by farmers in each region from the national average prices found in the FAPRI and ND simulation models. Table 3 shows the projected North Dakota prices based on FAPRI's estimates and Table 4 shows prices based on the Global Wheat Policy Simulation Model (GWPSM). FAPRI assumes that wheat prices will fall to the lower $5.00 range for wheat and upper $3.00 range for corn. The GWPSM projects wheat prices to remain near $7.50 per bushel through out the projection period and corn near the lower $5.00 range. Two scenarios were run, one with FAPRI based prices and the other with GWPSM based prices. Futures prices for wheat and corn over the next two years are close to the GWPSM based prices.

Table 3. North Dakota Baseline Price Estimates from the Projected FAPRI Scenario

	Spring Wheat	Durum Wheat	Malting Barley	Sunflower	Soybeans	Corn	Canola
	----------$/bu----------			-$/cwt-	-------$/bu-------		-$/cwt-
2007	6.64	9.44	3.81	18.78	8.95	3.82	16.81
2008	5.24	7.45	3.21	19.02	9.06	3.74	17.02
2009	5.17	7.35	3.15	17.94	8.55	3.72	16.06
2010	5.13	7.29	3.04	18.21	8.68	3.62	16.30
2011	5.20	7.39	3.08	18.01	8.59	3.66	16.12
2012	5.25	7.46	3.10	18.29	8.72	3.70	16.37
2013	5.36	7.62	3.15	18.45	8.79	3.78	16.52
2014	5.41	7.69	3.14	18.65	8.89	3.77	16.70
2015	5.47	7.77	3.16	18.65	8.89	3.80	16.70
2016	5.50	7.81	3.12	18.76	8.94	3.75	16.79
2017	5.53	7.86	3.12	18.60	8.86	3.75	

Table 4 North Dakota Baseline Price Estimates from the Projected GWPSM Scenario

	Spring Wheat	Durum Wheat	Malting Barley	Sunflower	Soybeans	Corn	Canola
	----------$/bu----------			-$/cwt-	-------$/bu-------		-$/cwt-
2007	6.64	9.44	3.81	18.78	8.95	3.82	16.81
2008	7.45	11.03	4.56	25.95	12.36	4.77	23.22
2009	7.26	10.72	4.43	25.03	11.93	5.11	22.41
2010	7.34	10.07	4.35	25.84	12.32	5.39	23.13
2011	7.32	10.02	4.34	25.18	12.01	5.24	22.54
2012	7.41	9.85	4.37	24.92	11.88	5.20	22.30
2013	7.41	9.99	4.36	24.79	11.81	5.14	22.20
2014	7.44	9.73	4.32	24.47	11.66	5.12	21.91
2015	7.43	9.75	4.29	24.43	11.64	5.08	21.87
2016	7.46	9.40	4.23	24.29	11.57	5.05	21.74
2017	7.38	9.66	4.16	24.30	11.58	5.05	21.75

Crop yields in each region also are predicted using the estimated yield equations for crops produced in each region. The yield equation for each crop in each region is specified in the same dynamic framework as that in the price equation, as follows:

$$y_{it} = b_0 + b_1 \text{ trend} + b_2 y_{it-1} + D_t + e_{it} \quad (7)$$

where y_{it} represents yield of a crop in region i in time t, and e_{it} is a random error term. A dummy variable (D) was used to compensate for two drought years: 1980 and 1988. The trend variable is included to capture changes in production technology.

This equation is estimated for each crop in each region using time series data from 1974 to 2006. The estimated equations are used to predict crop yields in each region. Figure 6 shows the estimated spring and durum wheat yields. Soybeans yields are expected to return to trend line levels in 2008 after higher yields in 2007 in the RRV and South Central regions. The yields show a slight upward trend throughout the forecast period. Figure 7 shows the estimated yields for corn and soybeans. Corn and soybean yields are expected to increase slightly over the forecast period.

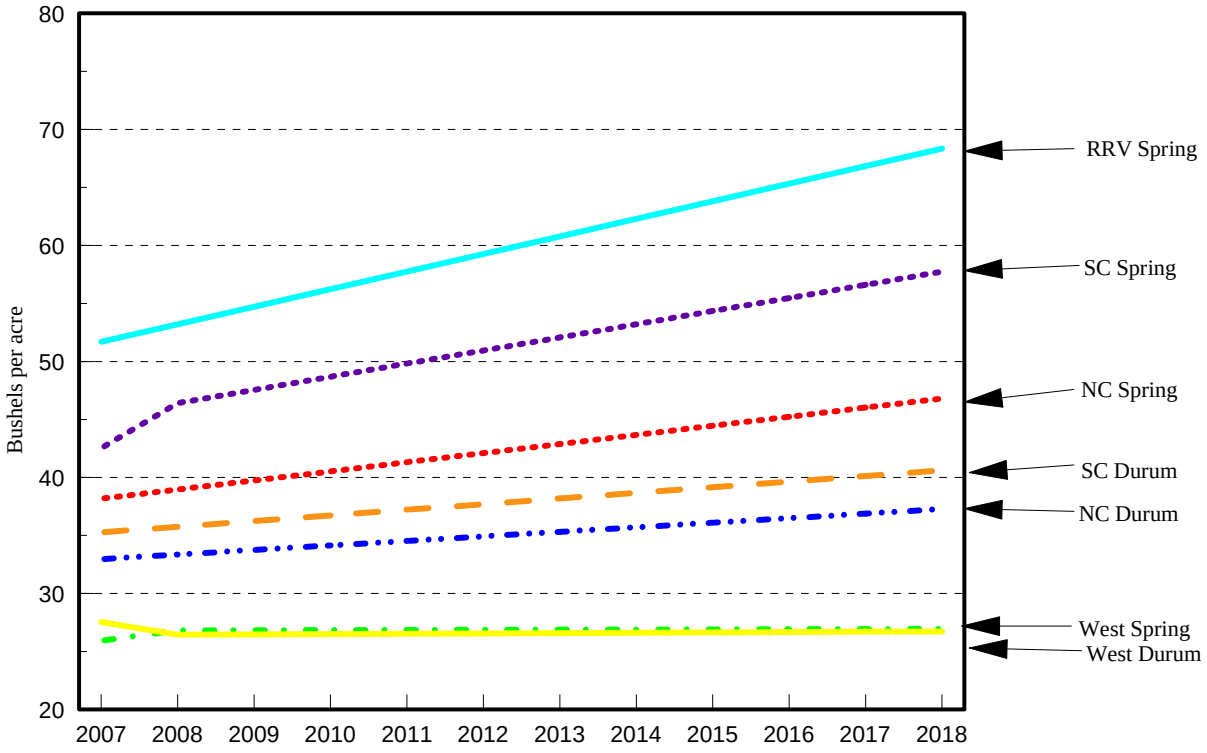


Figure 6. North Dakota Estimated Wheat Yields Used in the Representative Farm Model

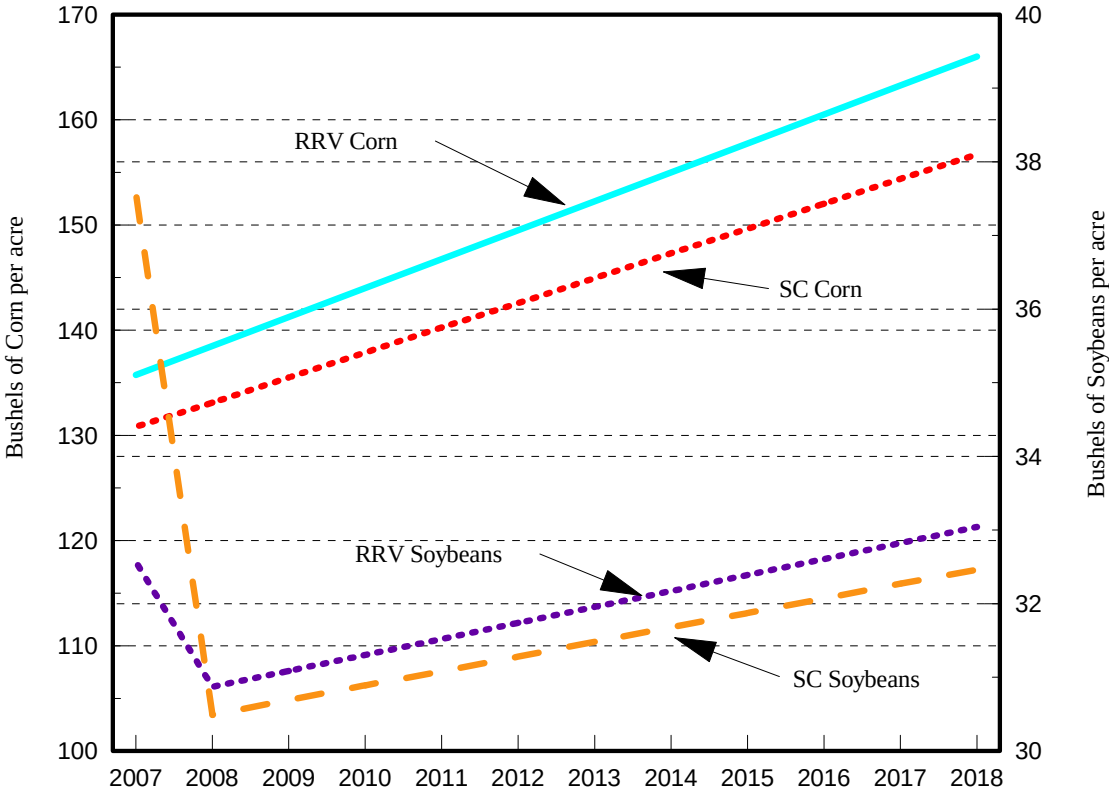


Figure 7. North Dakota Estimated Row-crop Yields Used in the Representative Farm Model

Crop mix changes over time as a function of prices of the crops produced in each region. A dynamic acreage equation for each crop is specified on the basis of Nerlove's partial adjustment hypothesis, as follows:

$$A_{jit}=c_o+\sum_{j=1}^{n} c_j P_{jit}+c_{n+1}A_{jit-1}+c_{n+2}G_{jt}+e_{jit} \qquad (8)$$

where A_{jit} = the total acres of the jth crop in region i in time t,
P_{jit} = the price of the jth crop in region i in time t,
G_{jt} = government policy variables applied to the jth crop in time t,
e_{jit} = a random error term.

The equations are estimated using time series data from 1976 to 2006. The estimated equations are used to predict the total acres of each crop produced in each region. The predicted prices from Equation 6 are used in the acreage equations. The jth crop share in region i in time t is then calculated as follows:

$$S_{jit}=A_{jit}/\sum_{j=1}^{i} A_{jit} \quad (9)$$

where S_{jit} is an acreage share of the jth crop in region i in time t.

The estimated share of a crop is applied to calculate the total acres of the crop produced in the region by multiplying the total acres in the region by the share.

Other data needed for the model are obtained from the North Dakota Farm and Ranch Business Management Association (farm record system data).

Farm size has been increasing about 2% per year. The size increase has been similar for all profit and size categories of farms. During the forecast period, the representative farms are allowed to increase 2% in size per year. With the increased size, expenses are allowed to increase about 2% above the expected rate of inflation to account for the additional acreage. Expenses have increased substantially in recent years. Since 2004, production expenses increased 51% and almost 9% between 2006 and 2007. Expenses are assumed to be 10% higher for 2008 than in 2007 and 8% higher in 2009 and 2010. After 2010, the expenses are assumed to return to a normal 2% to 3% growth per year.

In the previous reports, livestock income was assumed to remain constant throughout the forecast period. For the past three years, the model was adapted to allow returns from livestock to follow FAPRI's projections for cow-calf returns in the future. FAPRI projects the cattle cycle to bottom in 2012 before recovering in 2017.

AGRICULTURAL OUTLOOK FOR THE REPRESENTATIVE FARMS, 2008-2017

The North Dakota Representative Farm Model was used to estimate net farm income, debt-to-asset ratios, land prices, and rental rates for 2008-2017.
Additional assumptions in this study are:

1. Net farm income from the production of other crops, including potatoes and dry beans, remains constant during the period.

2. The farm equipment stock remains constant, indicating that depreciation allowances are invested back into farm equipment.

3. Inventory changes, accounts receivable, accounts payable, and prepaid expenses and supplies are constant from year to year.

4. The U.S. farm program and macroeconomic policies remain the same the same during the forecasting period.

5. Weather conditions and other factors affecting production practices are normal.

Net Income for North Dakota Representative Farms

Two models were run, one based on FAPRI prices which were estimated in January 2007, and the other based on the GWPSM. Table 5 presents net farm income for farms by size and profitability utilizing FAPRI's price forecasts. Average net income for North Dakota representative farms varies, depending upon the size of farm and its profitability. The net income for the large size farm will decrease from the 2005-2007 average of $216 thousand to $194 thousand in 2017, which is a 10% decrease (Figure 8). Net farm income for the medium size farm, which averaged $85 thousand for 2005-2007, increases to $88 thousand in 2017. Net farm income for the small size farm averaged $29 thousand for 2005-2007 and will decrease to $13 thousand in 2017. State average net farm income over the 10-year period is $163 thousand for the large size farm, $81 thousand for the medium size farm, and $17 thousand for the small size farm. The reason for the decrease in net farm income for the large size farm is due to the very high income levels in 2007. All incomes were at historical high levels in 2007. A substantial portion of the income is due to changes in inventories and accounts receivable. Net cash income for the large size farms in 2007 averaged $153 thousand compared to $404 thousand based on the actual data. The higher income levels imply that most farms in North Dakota will have enough income under the current farm bill and international market conditions, although the small size farm may need off-farm income to supplement family living.

Table 5. State Average Net Farm Income for Different Size and Profit Representative Farms Under the FAPRI Sceanrio

	Size			Profit		
	Large	Medium	Small	High	Average	Low
	---dollars---					
2005-07 avg	216,147	84,915	28,663	312,542	110,433	-10,451
2007	403,718	141,825	36,456	562,777	204,749	15,107
2008	184,940	91,083	31,274	230,712	115,803	18,043
2009	149,737	78,057	24,110	187,746	91,683	7,758
2010	130,889	68,966	17,012	168,512	76,919	1,522
2011	129,281	68,780	14,942	164,398	71,526	-14
2012	136,548	71,739	14,576	171,734	73,090	529
2013	155,349	78,740	13,939	184,617	78,257	1,162
2014	169,958	83,903	13,311	195,315	80,746	1,370
2015	183,494	88,181	13,446	202,679	84,179	2,036
2016	194,037	87,653	13,032	211,724	87,152	2,350
2017	194,377	88,290	13,078	230,787	94,312	3,452

Table 6. State Average Net Farm Income for Different Size and Profit Representative Farms Under the GWPSM Scenario

	Size			Profit		
	Large	Medium	Small	High	Average	Low
	dollars					
2005-07 avg	216,147	84,915	28,663	312,542	110,433	-10,451
2007	403,718	141,825	36,456	562,777	204,749	15,107
2008	399,253	185,464	54,205	509,407	245,794	53,674
2009	372,443	176,747	47,711	457,105	217,171	41,997
2010	366,621	177,479	44,917	440,972	204,244	36,279
2011	332,481	165,871	41,124	398,639	179,531	26,981
2012	312,512	159,749	38,270	383,491	164,462	20,764
2013	296,072	154,581	36,490	343,729	148,333	13,282
2014	291,921	153,919	36,389	323,479	135,634	8,140
2015	306,103	157,695	37,123	315,721	130,994	5,533
2016	313,853	156,717	36,792	319,880	131,873	5,077
2017	316,628	160,310	37,777	338,231	138,694	5,677

The increases in net farm income from 2008 to 2017 results from increases in yields and steady prices, which make up for any increases in expenses. Future crop production in the United States and around the world is predicted to be consistent with annual trend line increases, while demand is predicted to increase slowly. Producers are protected from price declines below loan rates specified in the 2002 farm bill. Any drop in prices below loan rates will be offset by an increase in governmental subsidies. Further price protection is available through counter-cyclical payments which are triggered when the national average price is less than the target price minus the direct payment rate. The counter-cyclical payment is decoupled from actual production and based on historical yields and 85% of base acreage. However, at current and projected commodity prices, neither marketing loans or counter cyclical payments will be made.

Net farm income for the high profit farm is projected at $231 thousand for 2008 and is expected to decrease to $164 thousand in 2011 (Figure 8) before returning to $231 thousand in 2017. Net farm income for the average profit farm is projected to be $116 thousand in 2008 and is projected to decrease to $94 thousand in 2017. The low profit farm is expected to show net farm income in 2008 of $18 thousand and slowly fall to $3 thousand by 2017. The low profit farm may not have the financial resiliency to survive without outside income. State average net farm income over the 2008-2017 period is $195 thousand for the high profit farm, $85 thousand for the average profit farm, and $4 thousand for the low profit farm. Net cash income, gross returns less expenses, for the high profit farms in 2007 were $182 thousand compared to $562 thousand for the accrual based net farm income. Net cash income for the average profit farms in 2007 was $94 thousand compared to $205 thousand for accrual net farm income and $33 thousand for the low profit representative farm. A substantial portion of the income is due to changes in inventories, accounts receivable and differed sales. The second model was run utilizing commodity prices obtained from the GWPSM. Those results present net farm income for high, medium, and low profit farms.

Projected net farm income are much higher with the GWPSM prices. Net farm income for the large size farm is projected to be $399 thousand in 2008, falling to $317 thousand by 2017 compared to $194 thousand for the FAPRI based prices. Net farm income for the medium size is predicted to be $185 thousand in 2008 and slowly falling to $160 thousand by 2017 compared to

$88 thousand for the FAPRI based model. The small size farm's net farm income in 2008 is expected to be $54 thousand before falling to $38 thousand in 2017 compared to $13 thousand for the FAPRI based model. Net farm income for the high profit farm is expected to be $509 thousand in 2008 compared to $230 thousand for the FAPRI based model. In 2017, net farm income is expected to fall to $338 thousand for the GWPSM based model compared to $231 thousand for the FAPRI based model. Net farm income for the average profit farm is expected to be $139 thousand under the GWPSM based model in 2017 compared to $94 thousand for the FAPRI based model. Net farm income for the low profit is expected to be $6 thousand in 2017 under the GWPSM compared to $3 thousand under the FAPRI based model.

The slow increase in farm size (2% per year) assists net farm income, but the increase in expenses each year eliminates much of the benefit. Increases in energy costs also weigh heavily on potential profits.

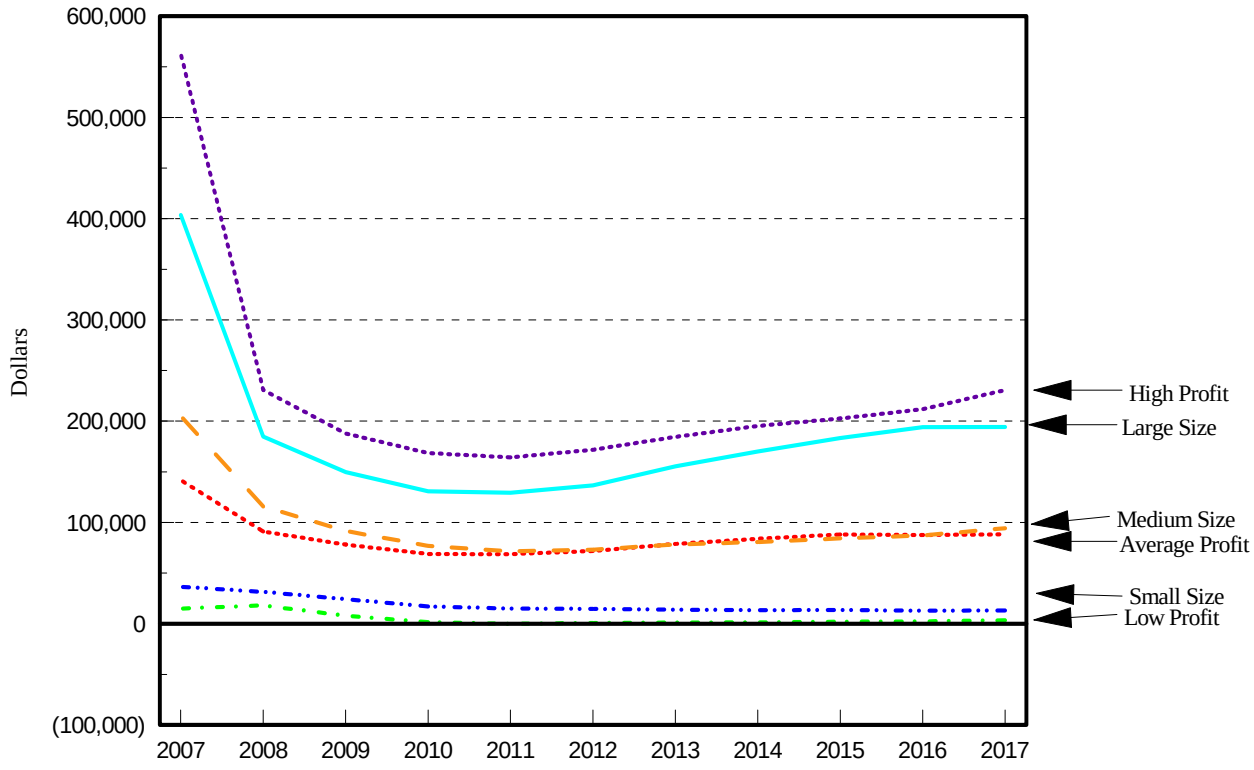


Figure 8. Net Farm Income for Size and Profit North Dakota Representative Farms Under FAPRI's Price Scenario

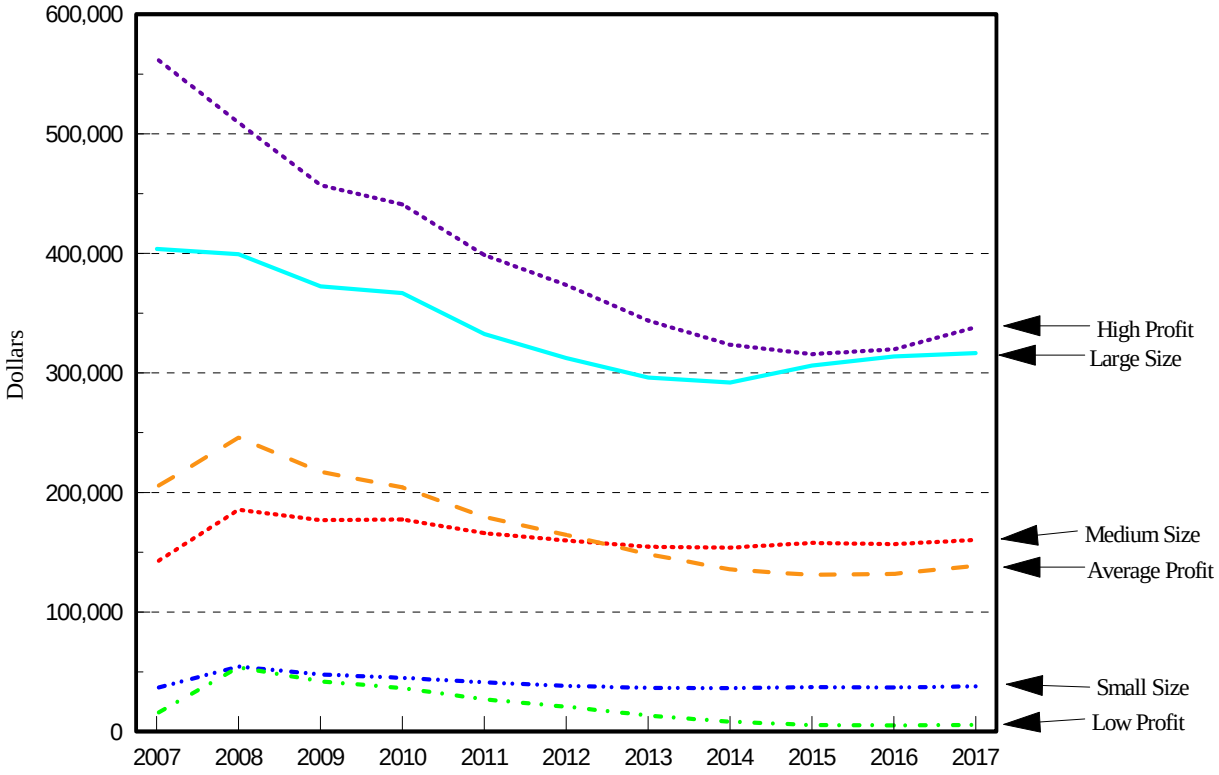


Figure 9. Net Farm Income for Size and Profit North Dakota Representative Farms Under GWPSM's Price Scenario

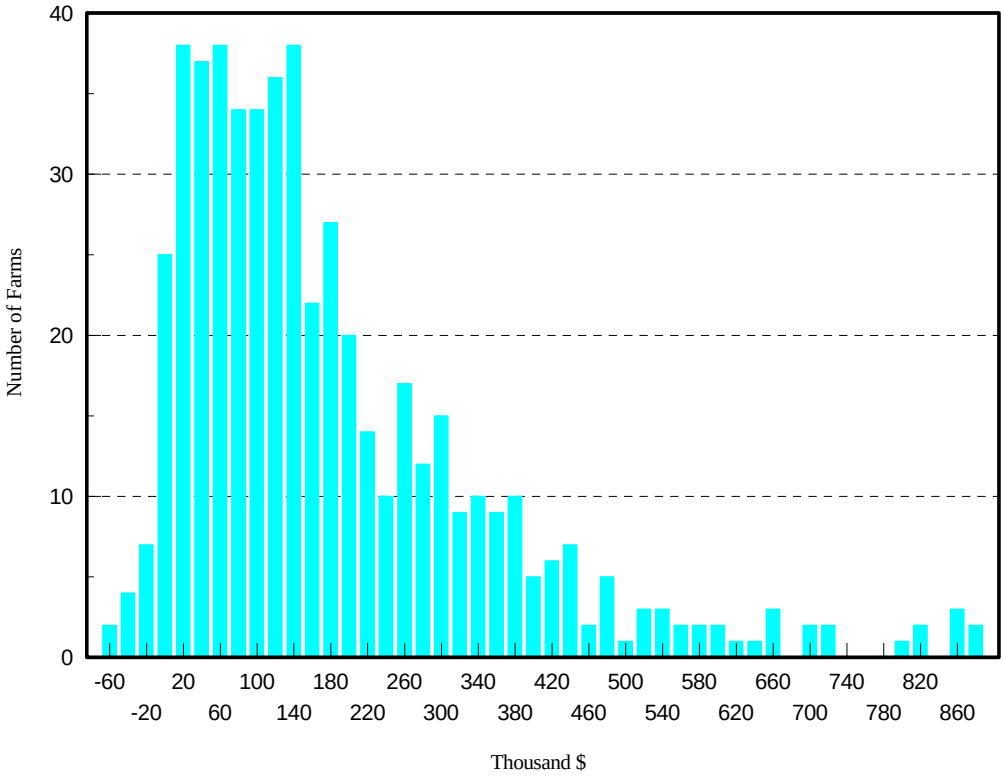


Figure 10. Number of Representative Farms in Each Income Category, 2007

Figure 10 shows the distribution at each income level for the average profit representative farm. A majority of the producers in the Farm and Ranch Business Management program are in the $40 thousand to $140 thousand range for net farm income with a long tail extending out to over $800 thousand.

Debt-to-asset Ratios for North Dakota Representative Farms

Debt-to-asset ratios for all representative farms fall except for the low profit farms throughout the forecast period (Table 7 and Figures 11-12). The debt-to-asset ratio is total debts, both long and short term, divided by total assets owned by the producer. The debt-to-asset ratio is one of the financial measures used to estimate the financial health of a business. The debt-to-asset ratio for the large size in 2008 is projected to be 0.232 and slowly falls to 0.204 by 2017. This indicates that total debts are about 23% of total assets for the large size farm. The medium size farm debt-to-asset ratio should be 0.278 in 2008 and falls slowly to 0.248 by 2017. The small farm's debt-to-asset falls from 0.414 in 2008 to 0.397 in 2017. The debt-to-asset ratio for the high profit farm falls from 0.362 in 2008 to 0.297 in 2017 and 0.406 in 2008 to 0.320 in 2017 for the average profit farm. The debt-to-asset ratio for the low profit farm remains relatively constant. The low income levels for both the small size and the low profit farms require income from outside sources for the family to continue farming. In 2007, low profit farms averaged over $28,000 in off farm income and small size farms averaged $24,000.

Table 7. State Average Debt-to-asset Ratios for Different Size and Profit Representative Farms

	Size			Profit		
	Large	Medium	Small	High	Average	Low
2007	0.206	0.267	0.417	0.409	0.454	0.552
2008	0.232	0.278	0.414	0.362	0.406	0.568
2009	0.234	0.280	0.418	0.315	0.356	0.604
2010	0.234	0.280	0.423	0.349	0.366	0.591
2011	0.231	0.277	0.422	0.347	0.363	0.590
2012	0.227	0.272	0.419	0.335	0.357	0.588
2013	0.221	0.266	0.416	0.329	0.352	0.583
2014	0.216	0.261	0.412	0.323	0.345	0.578
2015	0.212	0.256	0.409	0.310	0.333	0.571
2016	0.207	0.251	0.400	0.303	0.326	0.567
2017	0.204	0.248	0.397	0.297	0.320	0.562
Average	0.222	0.267	0.413	0.327	0.352	0.580

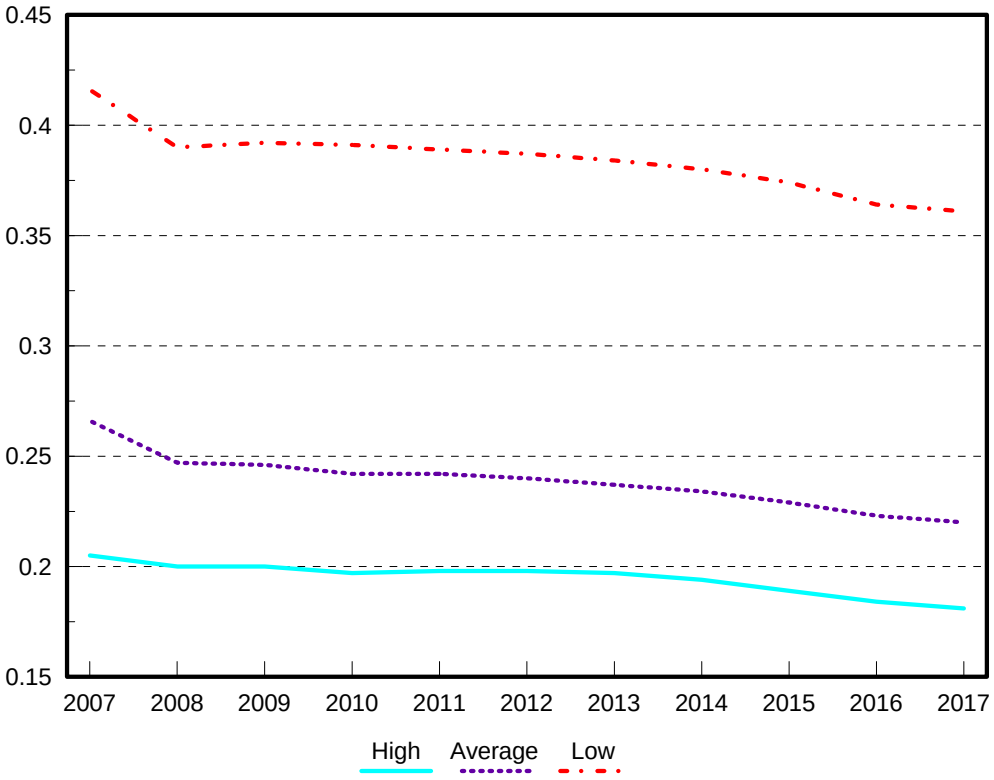


Figure 11. Debt-to-asset Ratio for North Dakota Representative Farms by Profit Category

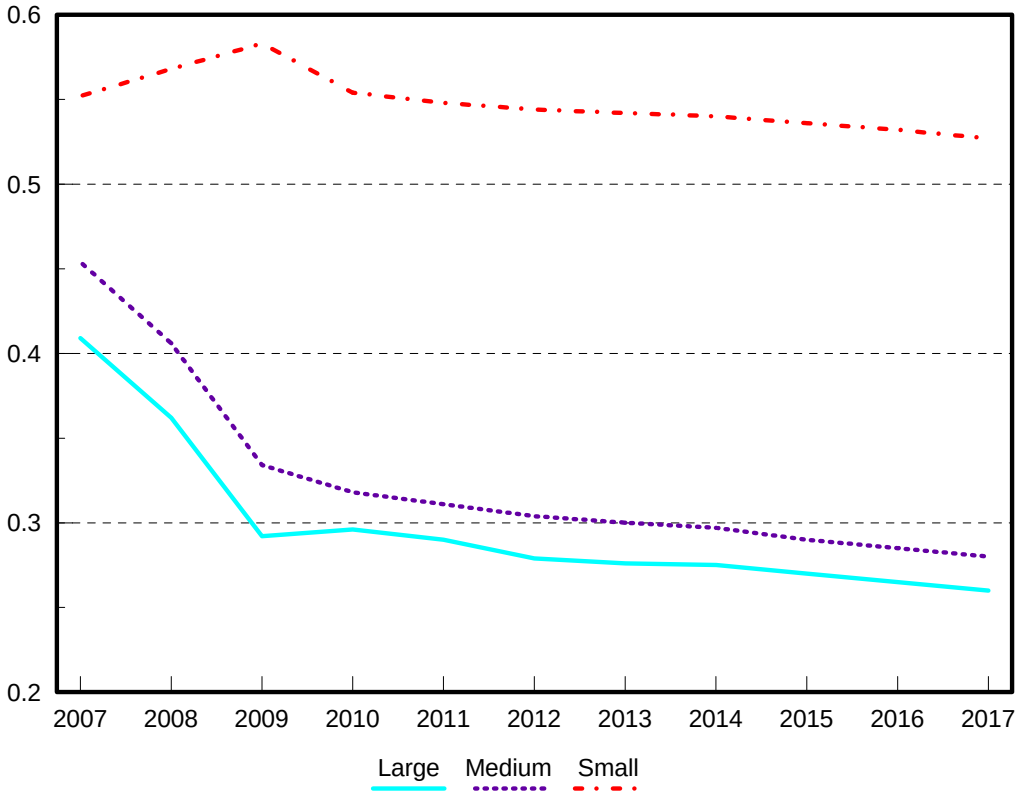


Figure 12. Debt-to-asset Ratio for North Dakota Representative Farms by Size Category

Farm Land Value and Cash Rents

Tables 8 and 9 present land values for representative farms in North Dakota under the FAPRI and GWPSM scenarios, respectively. Land values have increased substantially in recent years. In 2004, average cropland values in North Dakota was $490 per acre, by 2007 that had increased to $842 per acre. Cropland values depend on return-to-land. Under the GWPSM scenario, projected prices are higher, therefore return-to-land is higher. Land values in the RRV increase from $1,439 per acre in 2007 to $1,512 per acre in 2017 under the FAPRI scenario and $1,642 per acre under the GWPSM scenario. Both of these scenarios likely under estimate land prices as actual RRV land prices increased almost 40% between 2006 and 2007. Producers, under very favorable income situations, seem willing to invest their assets in land at higher rates than during normal income periods.

Cash rents follow land price which increases operating expenses. Land values for the average profit representative farms under the FAPRI scenario are shown in Figure 13. Land prices differ between the regions; the highest prices are in the RRV, and the lowest are in the West region. Land prices are expected to increase by 5.1% for the FAPRI scenario and about 13% for the GWPSM scenario over the forecast period. Land values are expected to increase 8.4% in the West region and 4.0% in the SC. Land values are based on return to crop acres. Other factors are not considered. Therefore, the land values and cash rents may not reflect current market values.

Table 8. North Dakota Land Prices for Average Profit Representative Farms Under the FAPRI Scenario

	RRV	NC	SC	West	State
	----------$/acre----------				
2007	1,429.57	629.36	818.29	492.11	842.33
2008	1,444.86	635.96	823.55	498.93	850.83
2009	1,454.20	640.78	828.07	504.87	856.98
2010	1,461.78	644.56	831.76	509.99	862.02
2011	1,468.91	647.83	834.92	514.70	866.59
2012	1,476.17	651.04	837.97	519.27	871.11
2013	1,483.80	654.31	841.28	523.66	875.76
2014	1,491.28	657.61	844.76	527.91	880.39
2015	1,498.55	660.95	848.45	532.20	885.04
2016	1,505.62	664.27	852.32	536.53	889.69
2017	1,512.53	667.49	856.36	541.07	894.36
2008-2017avg	1,479.77	652.48	839.95	520.91	873.28

Table 9. North Dakota Land Prices for Average Profit Representative Farms Under the GWPSM Scenario

	RRV	NC	SC	West	State
	----------	----------	$/acre	----------	----------
2007	1,429.57	629.36	818.29	492.11	842.33
2008	1,456.48	645.74	831.05	503.16	859.11
2009	1,478.69	660.17	842.66	513.10	873.66
2010	1,500.83	674.14	854.22	522.21	887.85
2011	1,521.82	687.26	864.89	530.75	901.18
2012	1,542.60	700.28	875.29	539.13	914.33
2013	1,563.18	713.06	885.65	547.19	927.27
2014	1,583.29	725.61	895.97	554.98	939.96
2015	1,603.03	738.08	906.41	562.70	952.56
2016	1,622.51	750.42	916.97	570.32	965.05
2017	1,641.86	762.54	927.69	578.07	977.54
2008-2017avg	1,551.43	705.73	880.08	542.16	919.85

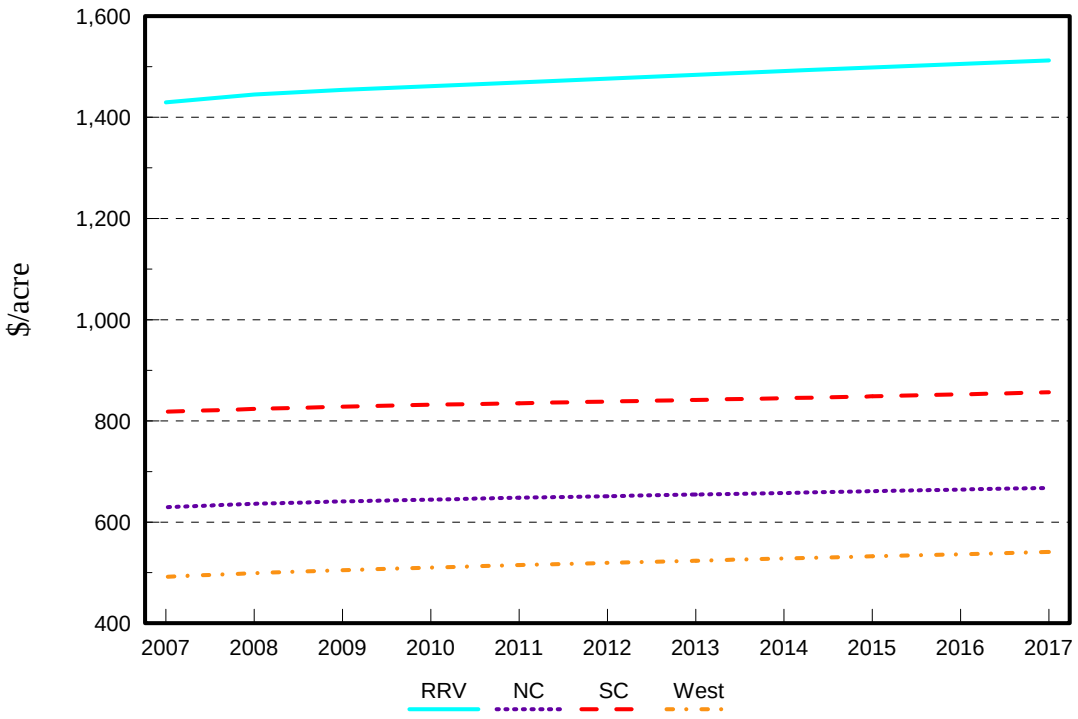


Figure 13. Average Value of Cropland for North Dakota Average-Profit Representative Farms Under the FAPRI Scenario

Cash rents for the average profit farms slowly increase in all regions for the FAPRI scenario (Table 10). Cash rents also differ between regions; the highest are in the RRV, and the lowest are in the West (Figure 14). According the North Dakota Farm and Ranch Business Management

Education program, RRV cash rent in the RRV averaged $68.64 in 2006 and $71.55 in 2007 even though land prices increased about 9% in the RRV.

Table 10. North Dakota Cash Rent for Average Profit Representative Farms Under the FAPRI Scenario

	RRV	NC	SC	West	State
	----------$/acre----------				
2007	64.98	39.34	45.46	28.95	44.68
2008	65.68	39.75	45.75	29.35	45.13
2009	66.10	40.05	46.00	29.70	45.46
2010	66.44	40.29	46.21	30.00	45.73
2011	66.77	40.49	46.38	30.58	45.98
2012	67.10	40.69	46.55	30.55	46.22
2013	67.45	40.89	46.74	30.80	46.47
2014	67.79	41.10	46.93	31.05	46.72
2015	68.12	41.31	47.14	31.31	46.97
2016	68.44	41.52	47.35	31.56	47.22
2017	68.75	41.72	47.58	31.83	47.47
2008-2017 avg	67.26	40.78	46.66	30.64	46.34

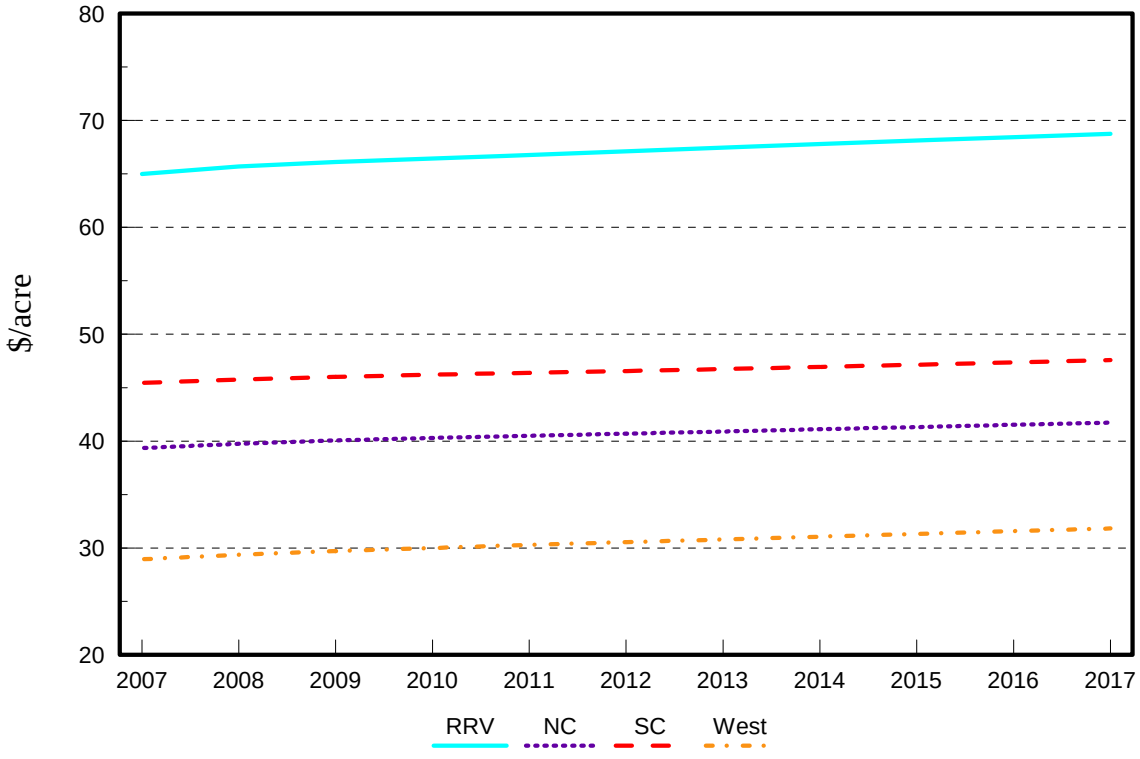


Figure 14. Average Cash Rent of Cropland for North Dakota Average-Profit Representative Farms Under the FAPRI Scenario

CONCLUDING REMARKS

Two scenarios were developed because of the high degree of uncertainty in future commodity prices. The first scenario utilized FAPRI's estimated commodity prices in the North Dakota price model and the second scenario used prices obtained from the GWPSM. Net farm income in 2017 may lower than in 2007 for most farms under both scenarios, however net farm income with GWPSM are much higher than under the FAPRI scenario. For example, net farm income for the average profit farm was $94 thousand in 2017 under the FAPRI scenario, but $139 thousand under the GWPSM scenario. FAPRI projected wheat price is at $5.56 in 2017 compared to $7.38 for the GWPSM. Production expenses increased 105% since 1994 and 51% since 2004. Continued increases in production expenses will erode incomes under both scenarios. It was assumed the expenses for 2008 will increase 10% above 2007 levels and 8% higher for 2009 before returning to a more normal 2% to 3% per year increase. Crop production in the United States and around the world is assumed to be normal with annual trend-line increases.

Debt-to-asset ratios are predicted to decrease slowly throughout the forecast period. Higher price levels will benefit all farms in the state.

Land values are predicted to increase during the forecast period because they are based on return-to-land. As a result, projected land values increase just over 5% for the projection period. However, recent North Dakota land prices have increased from $490 per acre in 2004 to $842 per acre in 2007. Cash rent levels follow patterns similar to land values. Current increases in market land values and cash rents are not reflected in the model as the model uses current returns to land and not future expected returns.

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