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Research Report 14-2

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Introduction

The Agricultural and Food Policy Center at Texas A&M University (AFPC), and researchers from the Food and Agricultural Policy Research Institute at the University of Missouri (FAPRI-MU), University of California at Merced and University of California at Santa Cruz have teamed together in a grant project to study farmer adaptation to climate change. This project is supported by Agriculture and Food Research Initiative Competitive Grant no. 2012-68002-19872 from the USDA National Institute of Food and Agriculture (NIFA). However, any findings and views expressed are those of the authors and might not reflect those of USDA or NIFA. The AFPC's primary role in this project is to gather farmers' perceptions and potential reactions to possible climate change impacts on localized growing conditions.

This working paper is the first step in a multi-step approach to gather information from producers and pass this information along to climate change modelers. Specifically, the AFPC has met with and gathered data from producers from select representative farms representing different parts of the United States on their perception of climate change. Additionally, in the latter years of the project, the AFPC will follow up with these same producers and present distributions of localized weather, yield, and price estimates under various climate change scenarios. Representative farm panels will gauge their adaptation strategy when confronted with different circumstances caused by climate change.

The two Nebraska representative farms (NEG2400 and NEG4300) were chosen to participate in this study. Detailed information about these farms and the data gathered from the producers is presented in the Methodology section. Other representative farms in the study include: TXNP3000, TXNP10000, IAG1350, IAG3400, KSNW4000, KSNW5500, NDG2500, NDG8000, MOCG2300, MOCG4000, and ALC3000. Figure 1 shows the location of the representative farms involved in this study. An advantage of this selection of farms is that they represent key corn-growing regions in the Corn Belt, as well as locations to the North and South of this region. Project results will investigate climate information needs of farmers in and near the main corn growing region and how they adapt to potential changes in growing conditions and markets, including in the course of crop selection.

Methodology and Description of the Representative Farm Process

Panel Process

AFPC has developed and maintains data to simulate 96 representative crop farms, dairies, and livestock operations chosen from major production areas across the United States. The representative farm approach treats a farm business unit as a unique system

characterized by local features and resources to which the farm manager adapts. Local conditions are internalized in the creation and simulation of each farm.

Figure 1. Locations of AFPC Representative Farms Utilized in Climate Project.

Information necessary to simulate the economic activity on these representative farms is developed from panels of producers using a consensus-building interview process. Producers in a location have been chosen that represent full time producers in the area utilizing the expertise of local extension staff who serve as facilitators. The panel members are tasked with providing the data needed to build a farm that is representative of their operations. Data include size of operation, land tenure, commodities produced, production practices, fixed costs, variable costs, equipment complement, yields, and prices received for their commodities. These data span the most recent 1-3 years. Often, two farms are developed in each region using separate panels of producers: one is representative of moderate size full-time farm operations, and the second panel usually represents farms two to three times larger.

Once the farm level data are reviewed, the panel data are combined with the latest baseline projections of agricultural commodity markets and rates of change in input costs produced by FAPRI-MU and associated institutions (FAPRI-MU, 2013) and simulated using the Farm Level Income and Policy Simulation (FLIPSIM) model (Richardson and Nixon, 1986). The producer panels are provided pro-forma financial statements for their representative farm and are asked to verify the accuracy of simulated results for the past year and the reasonableness of a six-year projection (Richardson *et al*., 2013). Each panel must approve the model's ability to reasonably reflect the economic activity on their representative farm prior to using the farm for policy analyses. If panelists

determine that the financial results are not valid, the input data will be revised. This process continues until the panel judges that the Representative Farm has been correctly constructed.

Description and Characteristics of Nebraska Representative Farms

The two Nebraska feed grain and oilseed farms are located near Lexington, Nebraska (Dawson County) in the south-central portion of the state. The producers comprising these panels operate primarily in the Central Platte Natural Resources District. Figure 1 shows the geographic location of this tandem of representative farms along with the other representative farms included in this project. Original development of these representative farms occurred in 2003; the majority of the original panel members are still actively cooperating with the AFPC representative farm project. These farms were initially established as corn and soybean farms with some alfalfa hay also grown on a portion of the acres. Nearby Gothenberg, Nebraska is home to a Frito Lay grain handling facility, so a portion of the corn on these farms is high value food-grade white and yellow corn.

As of our most recent update in April 2013, the moderate-sized farm (NEG2400) plants 1,600 acres of corn and 800 acres of soybeans each year for a two-thirds/one-third corn/soybean rotation. AFPC simulations of the representative farm financial performance based on aggregate market data from the FAPRI December 2013 baseline, suggest that this farm generated 76 percent of its receipts from corn and 24 percent from soybeans in 2012.

The large-sized Nebraska feed grain and oilseed farm (NEG4300) currently plants 3,000 of its crop acres to corn, 1,000 acres to soybeans, and the remaining 300 acres to alfalfa hay. The alfalfa hay is re-established every six years. This farm is slightly more aggressive in planting corn in consecutive years on the same ground, as it is currently achieving a 75 percent corn to 25 percent soybean rotation on the row-crop acres. AFPC simulation results for this farm suggest that it earned 76 percent of its 2012 receipts from corn production, 17 percent from soybean production, and the remaining 7 percent from alfalfa hay sales.

The region of Nebraska in which these representative farms are found is highly productive. Budgeted corn yield is 200 bushels per acre for the moderate-sized farm and ranges from 200 to 210 bushels per acre for the large-sized farm, with food-grade corn yielding slightly lower than corn raised for feed. Soybean budgeted yields are 65 bushels per acre for both farms. Strip-till is the common tillage practice in the region. Cropland of the region consists of predominantly silt loam soils, most belonging to the Holdrege Series. This series comprises approximately 1.8 million acres of south-central Nebraska. Table 1 identifies planting and harvest date ranges, tillage practices, and other farm-specific attributes of the two Nebraska representative farms.

Table 1. Attributes of Nebraska Representative Feedgrain and Oilseed Farms.

Crop	Corn	Soybeans
Estimated Planting Date	April 15-April 22	May 1-May 10
Estimated Harvest Date	October 1	Sept. 20
Yield Range (bushels/Acre)	200-210	65
Major Pests	Corn Rootworm; Borer	-
Irrigated	Yes	Yes
Typical Irrigation Water	10.5 acre-inches	10.5 acre-inches
Tillage Practice	Strip Till*	Strip Till*
Soil Texture	Silt Loam	Silt Loam

* For a description of tillage practices, refer to: http://www.extension.iastate.edu/publications/pm1901c.pdf

Financial Summary

A baseline financial outlook for each of the two Nebraska feedgrain farms was established using FLIPSIM assuming commodity prices and rates of change for input prices reported in the December 2013 FAPRI Baseline. The farms were simulated 500 iterations using a distribution of possible price and yield combinations, allowing the model to incorporate price and production risk into the analysis. Table 2 includes 2012 asset values for the two farms along with mean projected outcomes for selected financial measures over the 2013-2018 study period. Additionally, Figures 2 and 3 illustrate the historical Net Cash Farm Income (NCFI) for each of the two farms along with a range of projected NCFI outcomes for 2013-2018. Ninety percent of the projected NCFI results fall within the outer two red lines, 50 percent of the results fall between the inner two blue lines, and the mean NCFI is depicted by the black line in the center. The bar graph at the bottom indicates the annual probability of the farm experiencing a cash flow deficit at the end of each projected year.

In addition to detailed financial measures, the Agricultural and Food Policy Center evaluates and scores the overall financial condition of each of its representative farms. Overall financial condition is a composite ranking based on the probability of a farm facing cash flow stress and the probability of a farm's real net worth declining over the course of the study period. Farms are classified as good, marginal, or poor based on these criteria.

NEG2400 experiences an almost nonexistent likelihood of facing cash flow stress throughout the projection period. With a 1 percent chance of negative ending cash throughout the projection period, the farm receives a "good" score with respect to its liquidity measure. Similarly, increasing land values and cash built earlier in the study period when commodity prices are most favorable allow the farm to build wealth throughout the period, thus it receives a "good" ranking with respect to its equity. Taking both measures into account, the farm receives a "good" overall financial ranking.

NEG4300 is projected to have very low chances of facing cash flow problems throughout the projection period, with only a 2 percent chance of a negative ending cash balance in 2018. The larger farm also is expected to have a minimal chance of losing real net worth by the end of the projection period, thus the farm is classified in "good" overall financial condition.

Table 2. Financial Characteristics of Nebraska Representative Feedgrain and Oilseed Farms.

	NEG2400	NEG4300
	--$1,000--	--$1,000--
Assets, 2012	7,171.0	23,681.0
Receipts, 2013-2018	1,982.4	3,660.0
Payments, 2013-2018	53.5	52.3
NCFI, 2013-2018	348.2	675.9
Cash Reserves, 2018	1,887.0	2,735.6
Nominal Net Worth, 2018	7,614.9	25,106.0

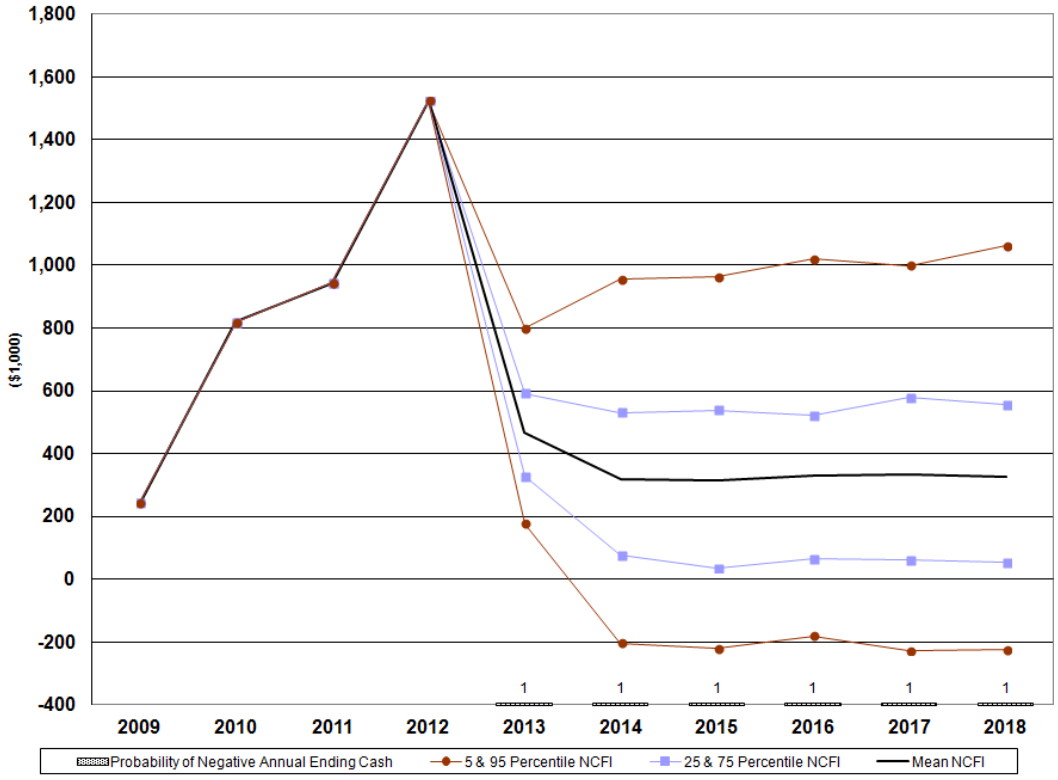

Figure 2. Net Cash Farm Income and Probabilities of Negative Ending Cash for NEG2400, 2009-2018.

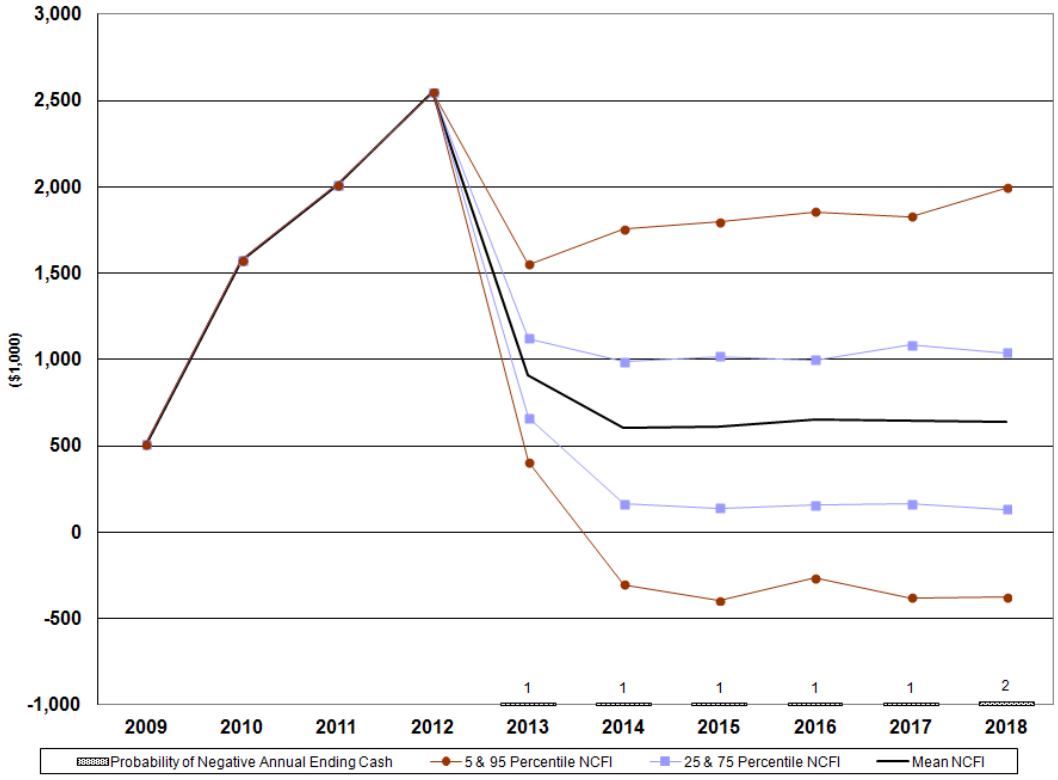

Figure 3. Net Cash Farm Income and Probabilities of Negative Ending Cash for NEG4300, 2009-2018.

Attitudes toward Climate Change

One of the objectives of this project is to discuss climate change and how it may be impacting producers' operations now and into the future. Most producers we visited with throughout all regions noted the climate has been changing since the beginning of time and are not particularly quick to concede that climate change, if it is indeed occurring, is the result of human activities.

Climate Change Adaptation

Comparing the Nebraska farm visit to our other two study-related trips in 2013, the Iowa and Texas farm visits, producers in this area lie somewhere between the other two groups with respect to their ideas about the prospects of adapting to a changing climate. The Texas group was dealing with long-term drought and Iowa was facing seemingly unceasing rainfall throughout the 2012 growing season. Producers in this part of Nebraska have faced recent drought conditions of their own, albeit less severe than the Texas panelists. The group related the story of how they received only an inch of rain between May and the time crops were harvested in 2012; at the time of our meeting in April 2013, almost a year later, area producers still had not experienced a single rainfall event exceeding ½".

Like the Texas High Plains group, these producers are readily equipped to mitigate the effects of drought through irrigation; however, similar to the Texas group, irrigation water is not unlimited. The Ogallala Aquifer is the underground irrigation water source for the predominantly center-pivot irrigated acres in the study region of Nebraska, and concerns with its depletion are well documented. The Central Platte Natural Resources District, in an effort to conserve the water supply and to help delay or avoid the need to further regulate irrigators, currently prohibits digging new water wells without offsets as well as the conversion of dryland acres to irrigation. This group is not ready to give up on their longstanding rotation of high-yielding irrigated corn and soybeans, but at least one producer indicated that if the drought situation does not turn around in the next year or two "things are going to get serious and we'll have to change".

Conclusions and future areas of the study

The first phase of the project focused on producers' attitudes and opinions on climate change. In general, the Nebraska group's thoughts on climate change are evolving as pointed out earlier in the paper. Additionally, vital production information was gathered. This information will be used to feed climate and economic models to forecast specific regional climate change impacts and to simulate agricultural commodity market impacts.

Future project work

The information obtained at this initial meeting will be transferred into climate models which will produce regional climate impacts. These impacts will be translated into crop yield and price ranges. Results will be of particular interest as farmers who

have not had climate change impacts communicated to them in terms of yield and price impacts that speak directly to their bottom lines. Our project team will disseminate these findings at the next representative farm update in Nebraska planned for 2015.

A Final Note

Results of our study will help farmers understand what climate change means for them. In the areas with Representative Farms, project reports will disseminate specific estimates and list adaptation strategies real farmers have identified. For farmers in other regions, the scale of impacts and the nature of adaptation options will inform decision making by alerting them to the ranges of possible outcomes, including the impacts on risk, and help them to assess the priority of developing adaptation strategies.

Our project, the first to exploit climate research findings and link them through yield and market effects to an existing extension network to deliver climate impacts to farmers, will be a step towards identifying and moving toward a sustainable adaptation to climate change. Moreover, by delivering results to farmers and policy makers, as well as academic audiences, investment and policy decisions will be better informed, helping the US agriculture and food sector to be sustainable in the context of new climate conditions.

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