Analysis of Current and Potential Limited Irrigation Methods for United States Department of Agriculture (USDA) Federal Crop Insurance Corporation (FCIC) Program

Final Research Report

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OVERVIEW

INTRODUCTION

AgriLogic Consulting, LLC (hereafter referred to as AgriLogic) has developed this report to address the objectives detailed in the United States Department of Agriculture (USDA) Risk Management Agency (RMA) Solicitation RFQ 1396983 - *Research of Current and Potential Limited and Subsurface Irrigation Methods for USDA Crop Insurance Program.* Per the requirement of the Food, Conservation, and Energy Act of 2018 (2018 Farm Bill):

> ***The contractor shall obtain program performance analysis and industry perceptions of the existing limited irrigation program and provide recommendations for improving participation.***

AgriLogic has worked with industry experts, producers, and state officials over the course of seven months to develop a comprehensive recommendation regarding the current and potential demand for the program as well as the perceived need. Notwithstanding its final recommendation, AgriLogic also provides strategies for RMA to consider regarding improvements for the program given the election of program continuance. The scope of the research was limited to irrigated practices related to corn and soybeans production in Kansas, Nebraska, and Colorado.

This report is divided into five major sections. The first includes a background and overview on the landscape of water use and availability issues. It then goes into detail on specific circumstances in Kansas, Nebraska, and Colorado and examines the impacts of regulations. The second section includes a background review of the Limited Irrigation Crop Insurance Program followed by an analysis of the current program in the fourth section. The fifth section includes conclusions on the effectiveness of the current program based on four formative factors. The final section includes recommendations from AgriLogic regarding proposed modifications for the continuation of the Limited Irrigation Crop Insurance Program.

BACKGROUND ON GROUNDWATER IN THE GREAT PLAINS

A large portion of the Great Plains of the United States rests over one of the largest freshwater aquifers in the world. The Ogallala Aquifer has been a groundwater source which agricultural producers have relied upon for decades to ensure quality crops and good yields even in drought conditions. Water utilization and recharge vary tremendously in different parts of the plains. The aquifer covers parts of eight states and the groundwater depths, capacities, and recharge rates differ depending on the specific location. In general, the aquifer is thicker toward the northern locations, with better recharge rates that may be more easily sustained with careful management as demonstrated in Figure 1.

Continued availability of an adequate supply of irrigation water is critical to agricultural production in many regions dependent on the Ogallala. It is estimated that by 2050, 35% of the Southern High Plains region will decline to the point that irrigation will not be economically feasible (KGS, 2015). Some areas, particularly parts of Texas, Kansas and Colorado, already appear to be in that situation. An overview of the water situation and water laws in each state provide a framework for the subsequent research, analyses, and recommendations contained herein.

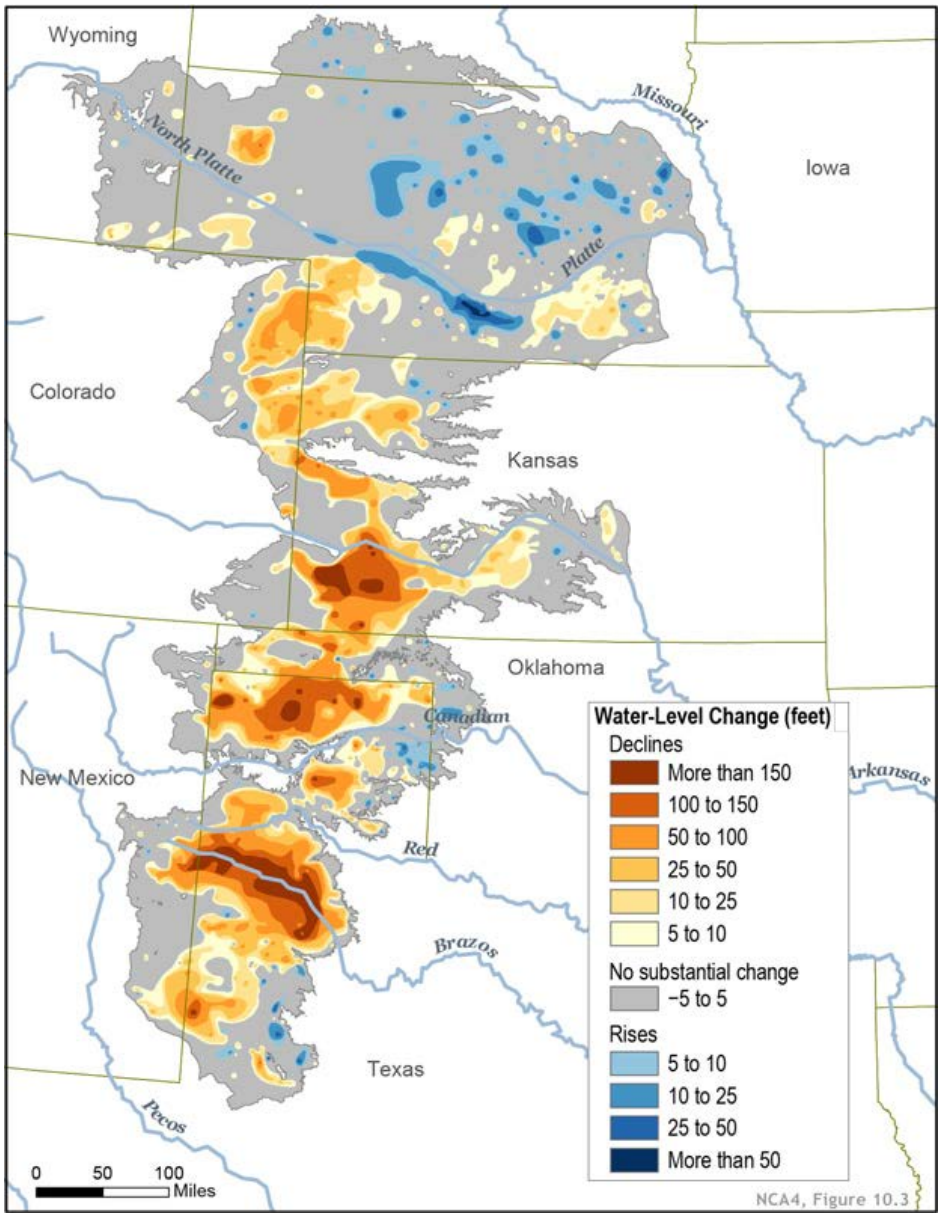

Figure 1. Ogallala Aquifer Water Level Changes, Predevelopment to 2015

Source: United States Geological Survey, 2020

Kansas

It was thought for many years that the water supply from the Ogallala would continue for generations, possibly indefinitely. High volumes of extractions for irrigation, however, have caused a rapid depletion of the Ogallala water supply, and it has become apparent to many agricultural producers that they will not be able to rely on this water source for irrigation as they have in past years. While many areas are facing this issue, Western Kansas has seen some of the most substantial losses in water availability, with many areas decreasing in saturated thickness more than 60 feet. In these critical areas, researchers project a lifespan of less than 25 years. Note that the High Plains Aquifer, which is depicted in Figure 2, includes the Ogallala as well as several smaller Pleistocene and alluvial aquifers.

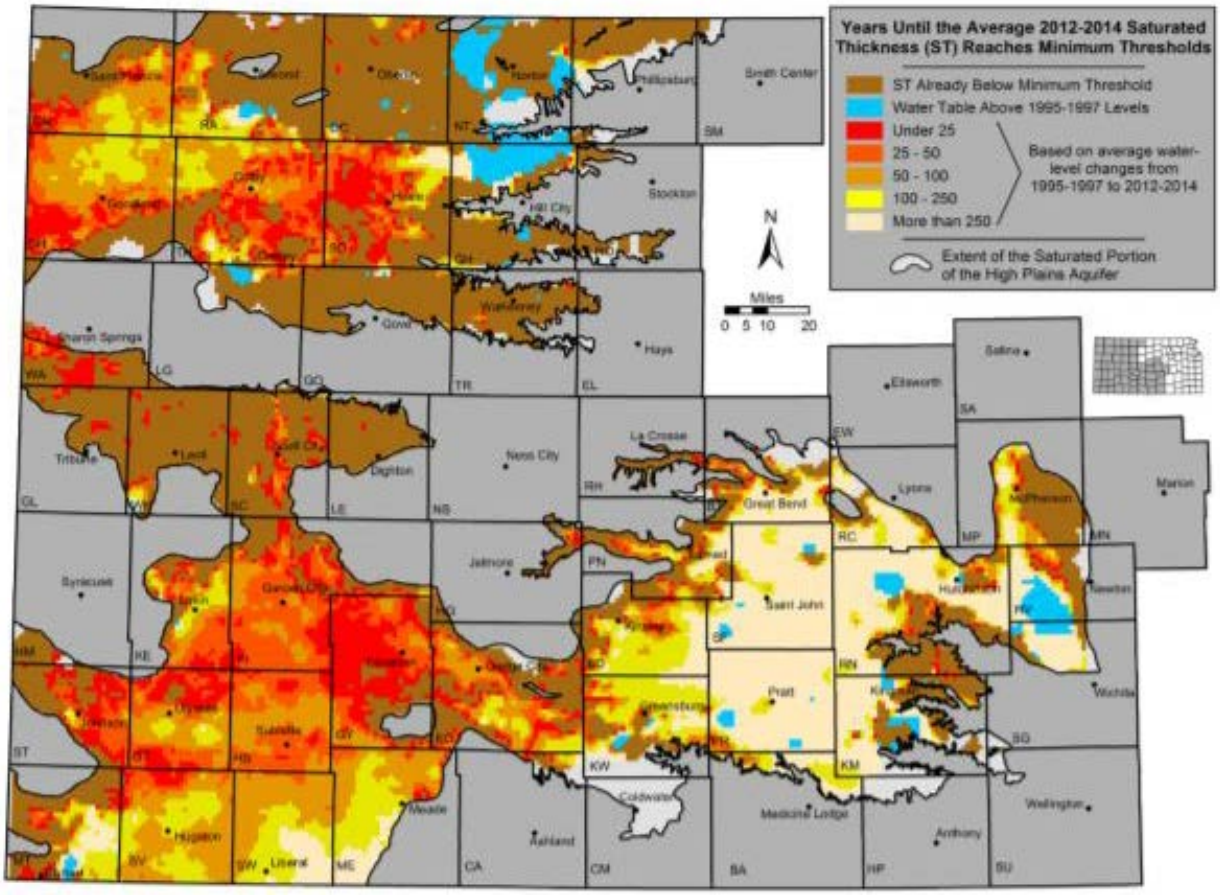

Figure 2. Estimated Usable Lifetime for the High Plains Aquifer in Kansas

Source: Kansas Geological Survey, 2015

Most of the Kansas water rights are based on the concept of prior appropriation established by state legislation in 1945 (CWI, 2017). Prior to 1945, irrigators were granted vested water rights that are senior to any appropriation rights. Several laws have passed since 1945 that have granted authority to local water districts to manage the water within their boundaries. One of these laws authorized the formation of Locally Enhanced Management Areas (LEMAs), including Sheridan 6, where the pilot Limited Irrigation Crop Insurance Program was initiated.

Five Groundwater Management Districts (GMDs) work together along with state and federal agencies to locally manage their water usage and ultimately regulate the water tables in the aquifer. The GMDs closely monitor the current and historical fluctuations in the aquifer and how it responds to implemented regulations. The districts have five purposes (GMD4, 2016):

1) Oversee conservation practices to ensure preservation of the aquifer on a local level;
2) Act as a resource to producers in the district to better manage their water use;
3) Contribute to the research and education effort of aquifer conservation;
4) Work as a median between producers and government officials to adhere to the Groundwater Management District Act; and
5) Manage resources in an efficient and economically beneficial approach.

The GMDs all served as a crucial resource during the research and listening session phases of this review of the Limited Irrigation Crop Insurance Program. John Hildebrand, conservation specialist for Big Bend GMD5, was an initial subject matter expert contacted in Kansas. Based on recommendations made by Mr. Hildebrand, AgriLogic scheduled listening sessions in St. John (GMD5), Garden City (GMD3), and Colby (GMD4), Kansas. A map of the five GMD locations is found in Figure 3.

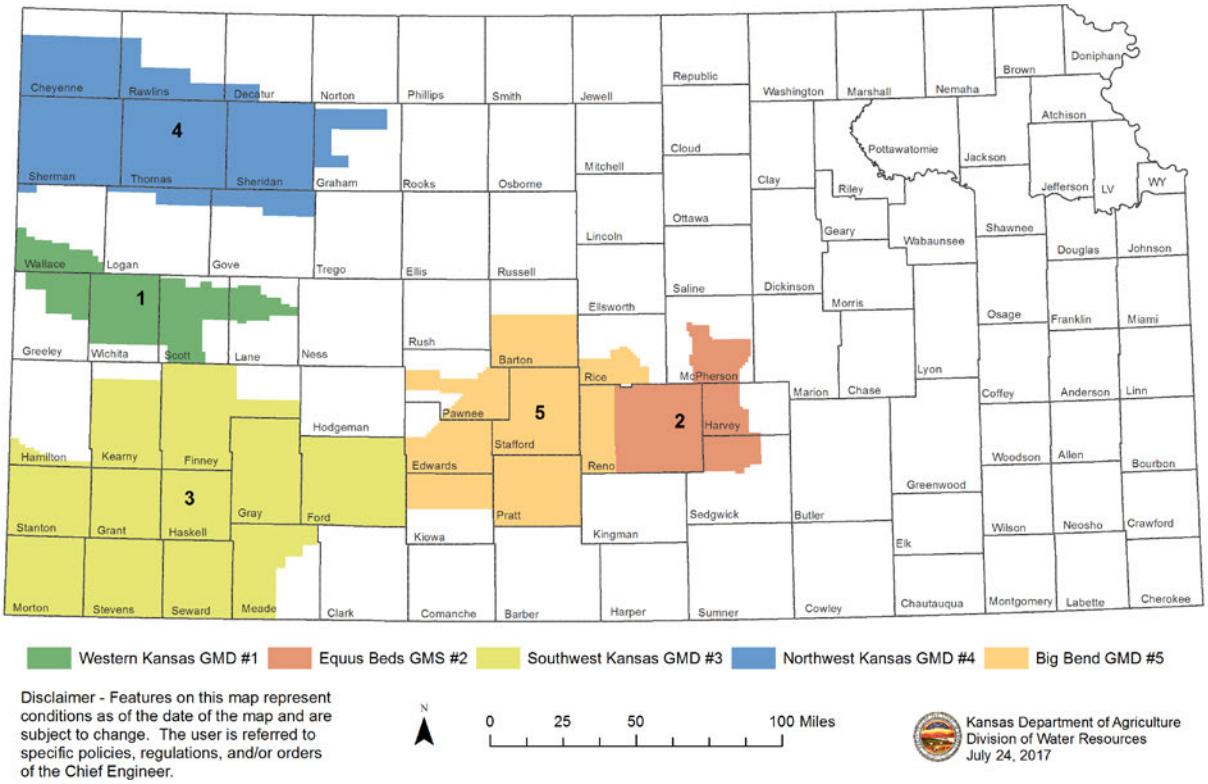

Figure 3. Groundwater Management Districts in Kansas
Source: Kansas Department of Agriculture, 2020

Nebraska

Nebraska has generally had a more abundant supply of groundwater that is also aided by a faster recharge rate compared to Kansas and Colorado, and most counties are expected to have more than 200 years until depletion (Ogallala Water, 2018). Until recently, Nebraska had the most irrigated acres of any state in the U.S., but an irrigation survey in 2018 shows California has surpassed Nebraska with 8.4 million acres while Nebraska has 7.7 million irrigated acres (NASS, 2019). Nebraska is not without its water challenges; however, the water shortage issues are mostly related to surface water. The worst drought in a quarter of a century was experienced in 2012, resulting in the Nebraska Department of Natural Resources ordering 1,100 farmers to halt irrigation from surface water sources as the rivers from which they drew from had dropped significantly. This did not dramatically affect the state's overall yields as the order did not pertain to well irrigation. Of the irrigated acreage in Nebraska, 90 percent pull water from wells rather than relying on surface water sources (Reuters, 2012). The NRD's also play a role in Nebraska's compliance with the Republican River settlement agreement between Kansas, Nebraska and Colorado. Nebraska's enforcement of the interstate compact directly involves the flow of surface water and in other cases the indirect impact of groundwater withdrawals on stream flows (Republican River, 2019).

Several legislative and governing measures were put in place in Nebraska to monitor groundwater use. Both the Reasonable Use Doctrine and the Correlative Rights Doctrine were

used in creating groundwater rights for Nebraska, ultimately giving the right to use groundwater to the owner of the land. The Reasonable Use Doctrine does require landowners to only use a reasonable quantity of water and in some cases may require them to share their water when supply becomes insufficient (Peck, 2017). Natural Resource Districts (NRDs) were established in Nebraska in 1972 to act as a local government unit working toward the conservation of the state's natural resources and, relevant to this study, solve groundwater issues (NRD, 2020). There are currently 23 NRDs that manage these issues across the state. AgriLogic has worked primarily with three NRDs where water depletion and restrictions are the most prevalent due to the slower recharge rate in comparison to the remainder of the state. The boundaries of the various districts are represented in Figure 4 with the red stars marking the Upper Republican, Middle Republican, and Lower Republican NRDs.

The initial contact for the Nebraska region was the Twin Platte NRD who recommended focusing on the North Platte, South Platte, and Republican NRDs. Calls with the North Platte and South Platte NRDs showed little interest in the limited irrigation program, however the Middle Republican NRD was an essential asset in setting up and promoting the listening sessions as well as providing feedback on the current water situation and contracts between states. The support of the Middle Republican NRD led the team to contact the Lower and Upper Republican NRDs who were also extremely helpful.

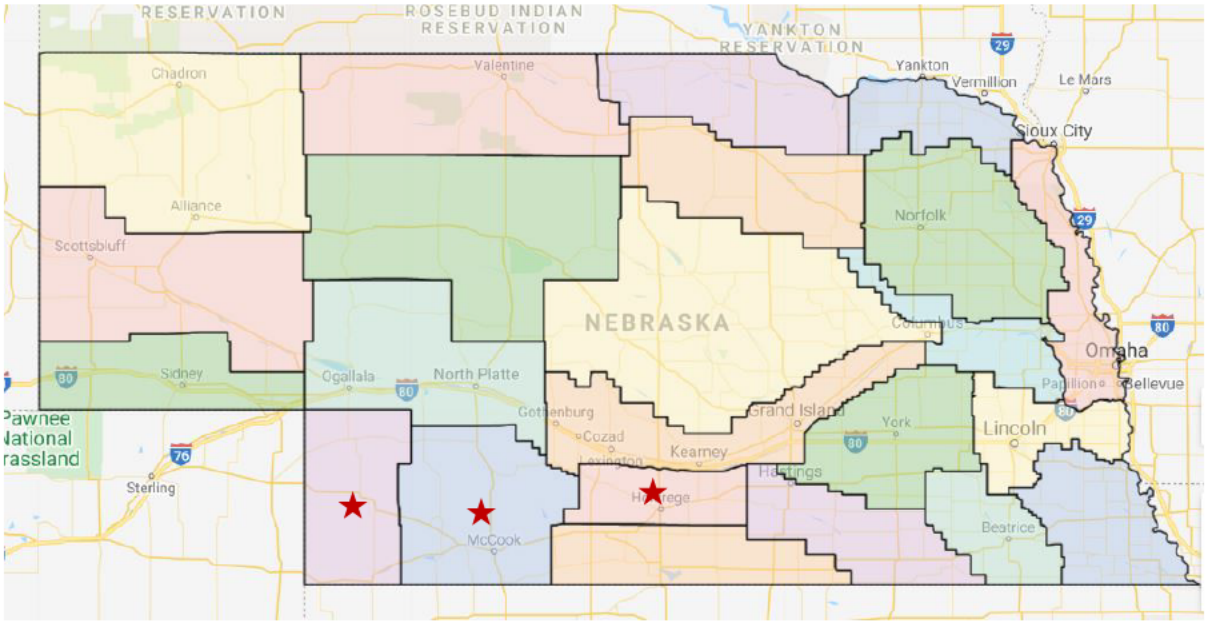

Figure 4. Nebraska Natural Resource Districts
Source: Natural Resource District, 2020

Colorado

The Ogallala Aquifer underlies nearly 14 percent of Colorado in the eastern portion of the state (Ogallala Water, 2018). Colorado has been highly proactive in attempting to conserve groundwater, resulting in a state loss of an estimated 600,000 acres of irrigated farmland between 1996 and 2016. The state water plan estimates that Colorado could lose another 600,000 acres of irrigated land by 2050 if the status quo of "buying and drying" irrigated land continues, resulting from rapidly growing urban areas buying up irrigation water. Colorado's cities are paying large sums of money for irrigation water rights and leaving the previously irrigated land limited to dryland farming (The Fence Post, 2017).

There are multiple groundwater laws in Colorado, with The Colorado Ground Water Management Act of 1965 being the most impactful. The act was critical in water regulation as it formed management districts that would later lead to preservation of water levels in the ground water basins (CDNR, 2020). Additional groundwater management has come from the Republican River Compact in 1942 and the Water Division Districts.

Surface water law in Colorado falls under the Prior Appropriation Doctrine. In the early development of water resource for mining, Colorado needed a different system than the riparian system which was the most common legal principle for regulating use of water from streams. This approach was not effective for many situations in Colorado where the mining operations were not close to a stream. As a result, the Prior Appropriation Doctrine was adopted.

The Republican River Water Conservation District (RRWCD) was created in 2004 as a result of the Republican River Contract. The District's primary function is to promote conservation of groundwater resources by using federal programs to voluntarily retire water rights. The District currently has two programs in effect to assist with these efforts. The Conservation Reserve Enhancement Program (CREP) was established to permanently retire a well, create a grassland habitat, and in turn reward the producer or well-owner with an annual payment under a 15-year contract. The Environmental Quality Incentives Program (EQIP) works slightly differently as large capacity water rights used for irrigation are voluntarily retired in return for compensation determined by the Natural Resources Conservation Service (NRCS) and RRWCD. Figure 5 shows the currently active wells in blue compared to EQIP retired wells in red and CREP retired wells in yellow.

Conversations with the Republican River WCD led the AgriLogic team to set up the initial listening session in Wray, Colorado. Due to the management structure of water use in Colorado, the team did not work directly with districts to host listening sessions. Instead, after speaking to water experts in the area, the team chose to host sessions at common producer meeting spots along the Kansas border where water rights have presented irrigation issues. Holyoke and Burlington, Colorado were the other two locations included in the listening session tour.

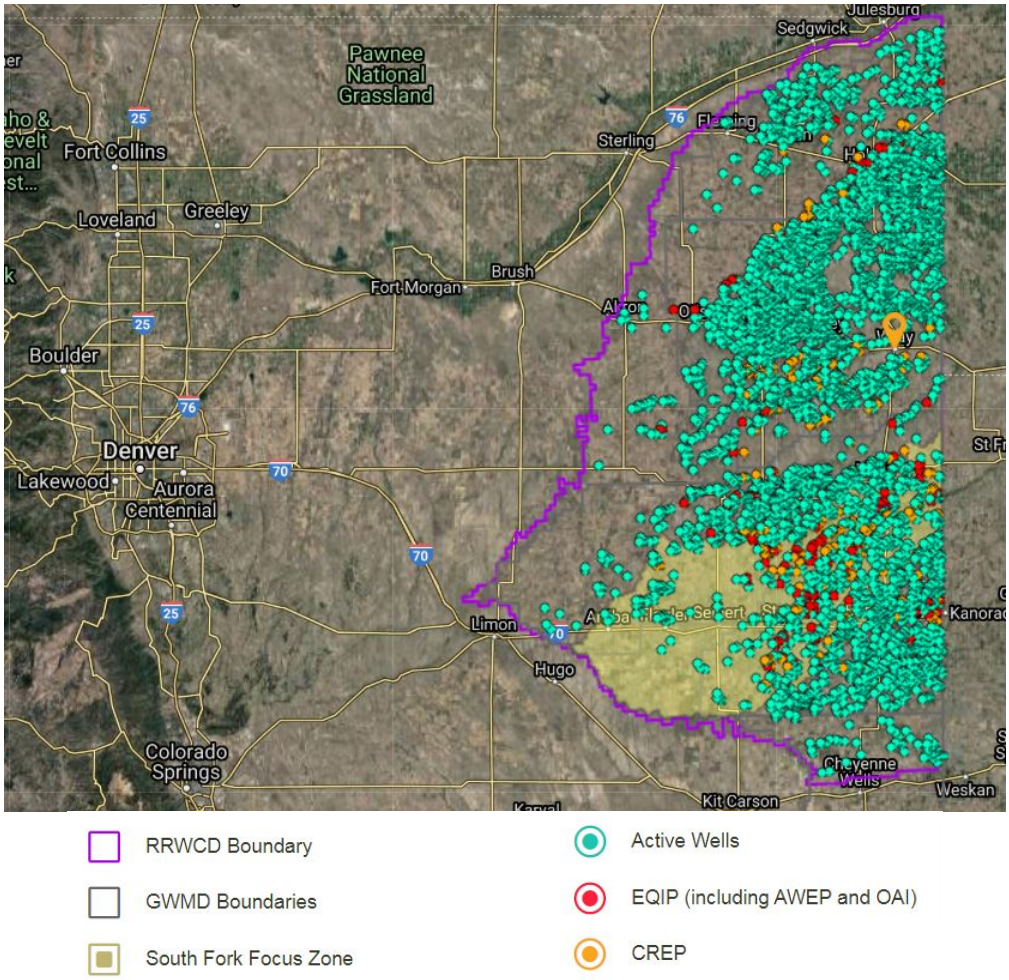

Figure 5. Republican River Water Conservation District Retired versus Active Wells Map

Source: Republican River Water Conservation District, 2020

DEVELOPMENT OF THE SHERIDAN 6 LEMA

With concerns of the lifespan of the aquifer and what that could mean for future generations, Kansas producers came together and enacted a plan to conserve the aquifer. The Sheridan County 6 High Priority Area, as shown in Figure 6, is an area of 99 square miles with 28,000 acres of irrigated land in Sheridan and Thomas Counties where producers proposed a reduction in irrigation water use over a period of time. In this area, there are 110 landowners who have historically pumped an average of 31,000 acre-feet per year. The plan was launched in 2013 with an allocation of 55 inches per acre over five years (an average of 11 inches per year compared to being allowed to use up to 14 inches prior to LEMA). Producers were given the choice of using all the water allocation the first year or to spread the use out over five years. The hard number in the order by the Kansas Water Office was that no more than 114,000 acre-feet of water could be used by the entire Sheridan 6 LEMA area for the period of 2013-2017 (Barfield, 2013). This amount included not only water for irrigation but for other purposes as well. Across the Sheridan 6 area, the restriction on producers was a limit of 55 inches over five years which on average

would be a reduction of 20 percent. From 2013 to 2017, groundwater use was actually reduced by 25.7 percent exceeding the initial goal of 20 percent. It is also worth noting that some producers had already adjusted their water use to this lower amount prior to the launch of the program.

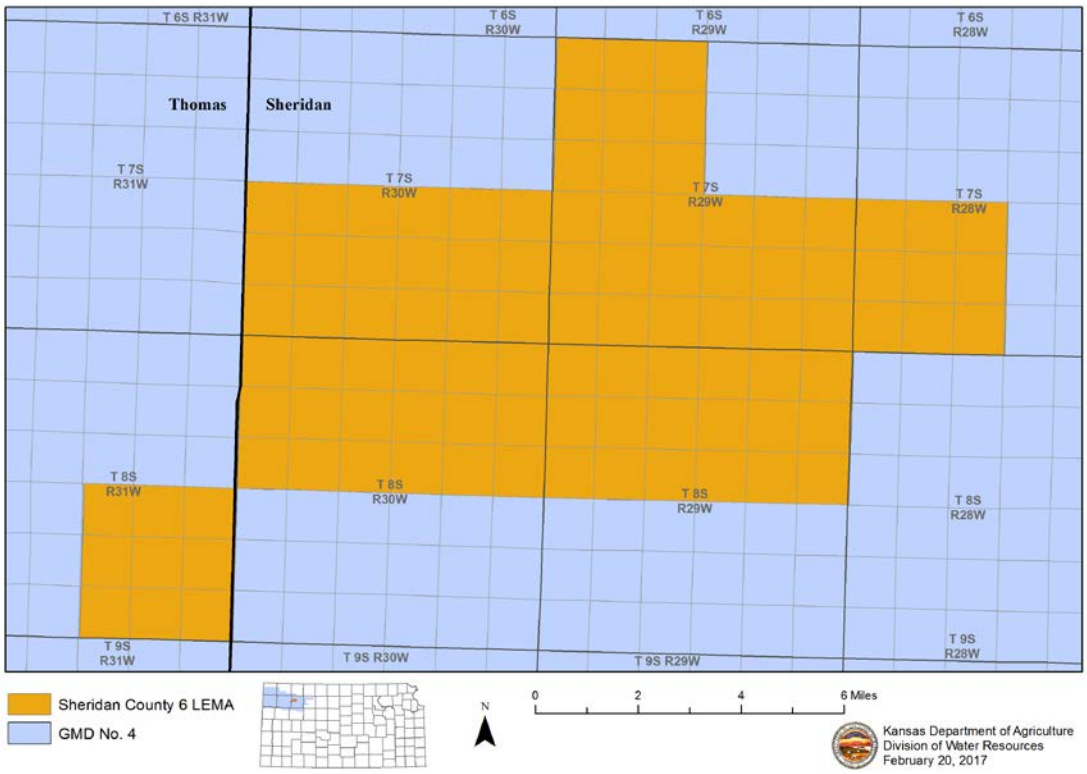

Figure 6. Original Sheridan County 6 LEMA

Source: Kansas Department of Agriculture, 2019

Sheridan 6 has been extended for another five years from 2018 through 2022. GMD4 has submitted a plan that the Chief Engineer has accepted, extending the LEMA to all parts of the district making it the first district-wide LEMA in Kansas. The district includes all or parts of 10 counties and covers over 3 million acres in northwest Kansas. A goal in this formation (DWR, 2017) was for the district:

> [t]o promote improved management of water used district-wide with a goal not to exceed 1.7 million acre-feet (AF) for irrigation over five years within the townships displaying an annual decline rate for the period 2004 to 2015 of 0.5% or greater annual decline and promote more efficient use by non-irrigation uses.

Different townships will have different water restrictions based on the extent of their water decline. The renewal of the original Sheridan 6 and its extension as a district-wide LEMA for

GMD4 are a testament to the strong support for water conservation in this area as well as validation of the LEMA concept.

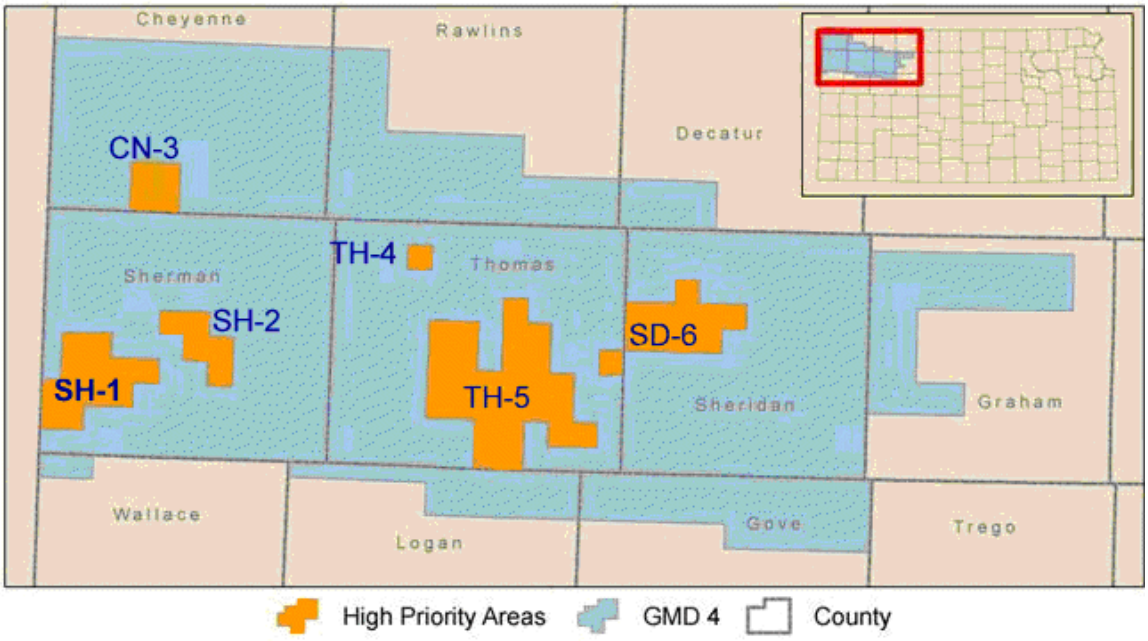

Figure 7. Northwest Kansas Groundwater Management District No. 4 High Priority Areas

Source: USDA RMA, 2019

LIMITED IRRIGATION CROP INSURANCE PROGRAM BACKGROUND

This section provides an overview of the Limited Irrigation Crop Insurance Program underscored by the previous discussion on water use and availability. The Sheridan 6 LEMA discussed above is one area covered by the current Limited Irrigation Crop Insurance Program. A brief discussion of the pilot program is provided along with current tools utilized in implementing the adjustment procedures.

The inevitable outcome of the various means employed to conserve water use in aquifer interaction areas is that agricultural producers must limit their individual water use, either voluntarily or by enforced prescription. Setting aside the discussion on property rights related to this issue, we are left to consider the implications specific to production practices and insurance. Without adequate water, producers are left with two primary options to continue production of a given higher-water-use crop without the limited irrigation program. The first alternative is plant fewer irrigated acres and report remaining acreage either as prevented planting, if eligible, or insure it under a non-irrigated production practice. The second alternative is to plant all acres with limited water and insure under a non-irrigated practice. Due to the rapidly declining water levels and increasing water restrictions, producers impacted by actual or potential restrictions were concerned that they would not be able to continue eligibility for fully irrigated insurance coverage, and that these restrictions would negatively impact their irrigated yields. These producers also realized the downfalls of insuring their acreage under a non-irrigated practice—with lower production guarantees and higher premium rates—if the water allocation and use was only reduced by a fraction. As a solution, producers sought an appropriate reduction to their yields which recognized the water restriction limitation but allowed them to continue to insure such acreage as irrigated.

Leaders in this area requested RMA to develop a new crop insurance alternative to support this new approach to water conservation that would provide a yield guarantee appropriate for the producers' reduced level of irrigation. In the development of the pilot program, the University of Nebraska–Lincoln (UNL), under a cooperative agreement with RMA, modeled the potential reduction in yield corresponding to a given reduction in water use to help producers in Kansas, Colorado, and Nebraska better understand the potential trade-off between various levels of water allocation and usage. This model would provide estimates of potential yields to assist these producers in making the best crop management decisions for their farms. The model developed by the UNL under cooperative agreement with RMA, including its features and appropriateness, is reviewed and discussed in a later section of this report.

Limited irrigation, as defined by RMA, is:

> "a method of producing a crop by which less water is artificially applied during the growing season by appropriate systems and at the proper times than the quantity of water that was used to establish the irrigated production guarantee or amount of insurance on the irrigated acreage planted to the insured crop."

This practice was created to assist producers in complying with many of the new regulations that have coincided with decreasing water levels of the Ogallala Aquifer. As producers use less water, it was assumed that yields would drop, resulting in a lower fully irrigated Actual Production Histories (APHs or approved yields). The limited irrigation practice was designed to track a producer's APH separately while allowing them to preserve their historical APH from their fully irrigated practice. By creating a limited irrigation practice, producers were allowed the flexibility of growing their irrigated crops within the guidelines of water usage in their area without penalty, outside of paying a slightly higher crop insurance premium rate associated with the lower approved yield.

Beginning with the 2013 crop year, RMA issued Special Provision statements authorizing limited irrigation written agreements for corn and soybeans in Sheridan 6. By offering coverage through written agreement for these acres, RMA was able to respond to a local conservation effort in a proactive manner and test the limited irrigation model and actuarial appropriateness of the adjusted irrigated premium rate associated with the limited irrigation practice in a small sample area. This area was the first LEMA plan approved by the Kansas Division of Water Resources representing approximately 100 irrigated producers.

RMA lists seven steps required of the producer in order to obtain limited irrigation coverage by written agreement if the producer has met the requirements to apply for the program. To be eligible, the producer must have an order to apply less irrigation water than previously used to sustain their APH, provide historical water use records and intended maximum level irrigation in gross inches on one of three types of irrigation systems (Center Pivot, Improved Gravity, or Gravity), and be willing to provide other pertinent information to the program. If the producer meets these requirements, the following steps are required to request coverage:

1) Contact a crop insurance agent to assist with completing and submitting the application;
2) Compile necessary documentation including but not limited to historical APH records, verification of previous water use, and an Actuarial Change form;
3) Review of information by the Approved Insurance Provider (AIP);
4) Submission of request from the AIP to the Topeka RO;
5) Topeka RO specialists verify information and a yield and separate database are approved;
6) The offer is sent back to the AIP for review;
7) An offer is sent to the producer to either accept or reject (USDA, 2018).

Expected Yield Reduction Methods

Reviewing reduced irrigation practices or limited irrigation practices and expected yield reductions.

In cooperation with RMA, the University of Nebraska–Lincoln (UNL) modeled the potential reduction in yield for a given reduction in irrigation. The UNL model is set up to evaluate water yields for Kansas, Colorado, and Nebraska based on one of three irrigation systems (Improved Gravity, Gravity, or Pivot System) by using a linear yield evapotranspiration (ET) crop production function that reflects the impact of water stress on crop yield. Only corn and soybeans can be evaluated under this model. The yield table worksheet allows each of these variables to be selected and computes yield adjustments accordingly. Documentation of full irrigation requirements, in addition to yield per inch of ET, and water use efficiency at full irrigation by crop and irrigation system at each location is required to implement the model (2019). The projections from the UNL model provide an idea of how yields might be expected to change for different amounts of water, but due to the small amount of data utilized, it has not been recommended that they should be used beyond the first step in determining the yield.

An example of the yield reduction procedure is provided in Table 1. This example is based on corn grown in Philips County, Colorado under a gravity irrigation system. The yellow-highlighted row represents a historical irrigation water use of 16 inches per year. The green-highlighted column represents a reduction of 3.25 inches per year. In this case, the expected reduction in corn yield is 19.7 bushels per acre.

Table 1. University of Nebraska–Lincoln Corn Yield Reduction Table based on Water Use Changes

Historical Water Use (in)	Reduction in Historical Water Supply, Inches of Gross Irrigation				
	2.75	3.00	3.25	3.50	3.75
	Reduction in Bushels per Acre				
15.50	-17.0	-18.7	-20.4	-22.2	-24.0
15.75	-16.6	-18.3	-20.0	-21.8	-23.5
16.00	-16.3	-18.0	-19.7	-21.4	-23.1
16.25	-16.0	-17.6	-19.3	-21.0	-22.7
16.50	-15.7	-17.3	-18.9	-20.5	-22.2

Source: RMA Deficit Irrigation Template, 2020

RMA Documentation Tool for Limited Irrigation

In 2016 the RMA Documentation Tool for the Limited Irrigation Crop Insurance Program was developed by the Kansas Geological Survey (KGS) under a sub-contract through the Kansas Water Office. The tool was designed to allow producers the ability to look up historical water use information online—free and publicly available—and calculate estimated yields based on the RMA yield tables developed by the UNL model. Users can access data using a water rights number that queries the Water Information Management and Analysis System (WIMAS) to show past water usage in reference to the crops planted for each year[1].

An example of the structure of the documentation tool is provided in Figure 8. Once a water rights number is provided, the user can view the potential types of use, producer information, insured crop, and system type in addition to 10 years of historical water usage collected from the WIMAS database which is updated daily (Wilson, 2017). In the yellow columns, producers can change their historical data manually if the WIMAS data does not accurately reflect one or more pieces of information. Column 20 is left blank and producers can then enter their historical yields in bushels per acre for each year. Calculated fields shown in blue are generated output. Yields that are entered and the resulting projections are not saved to maintain producer confidentiality.

A producer can explore customized yield projections based on proposed water applied and irrigated acres. Once these are entered in Columns 22-23, the outputs of proposed water use, percent reduction in average water use, and expected reductions in yields are provided in Columns 24-28. These outputs are based on the averages of Columns 18-21 and are calculated using the RMA yield tables for limited irrigation applications. Once calculated, the producer can then enter the values into the RMA Cost Estimator to obtain a premium quote associated with their limited irrigation yields for specified units. This website serves as a planning tool for the user and provides easy access to documentation of water use for the purpose of obtaining a limited irrigation written agreement.

[1] This information can be accessed by inputting a specific water rights number at the following link: http://hercules kgs.ku.edu/geohydro/rma/wr_lookup.cfm.

1. Crop Year:	2021	4. Producer Name:		7. Phone:	
2. State:	Kansas	5. Address:		8. Tax ID:	
3. County:	Thomas	6. City, ST, Zip:		9. Policy Number:	
10. Insured Crop:	Corn	12. FSN:		14. Unit:	
11. System Type:	Pivot System	13. Tract:		15. Field:	

16. Year (uncheck box to exclude)	17. Reported Crop	18. Reported Water Diverted (Acre-Feet)	19. Reported Acres	20. Yield (After trend, substitution, exclusion, as applicable)	21. Water Applied (Acre-Inch)
☑ 2017	Corn	105.00	123	238	10.24
☑ 2016	Corn	141.00	123	210	13.76
☑ 2015	Corn	88.00	123	219	8.59
☑ 2014	Corn	121.00	123	213	11.80
☑ 2013	Corn	123.00	123	159	12.00

22. Proposed Water Applied (Inch per Acre)	23. Proposed Irrigated Acres	24. Proposed Water Use (Acre-Feet)	25. Percent Reduction in Average Water Use	26. RMA Estimated Reduction in Bushel Per Acre	27. Expected Yield (Average Yield - Estimated Reduction)	28. Expected Percent Reduction in Yield
11	240	220.00	0.00%	-25	182	12.25%
11	240	220.00	0.00%	-25	182	12.25%
11	240	220.00	0.00%	-25	182	12.25%
11	240	220.00	0.00%	-25	182	12.25%
11	240	220.00	0.00%	-25	182	12.25%

29. Notes:	

Figure 8. Example Display of the RMA Documentation Tool
Source: Kansas Water Office, 2020

EDUCATION AND OUTREACH EFFORTS

Reviewing Risk Management Education outreach and lessons learned.

To prepare for listening sessions, AgriLogic reviewed training materials[2] developed by RMA to encourage producers to participate in limited irrigation practices. These training materials, dated February 14, 2018, were used as a resource for developing talking points to be discussed during the listening sessions:

1) How to Request Limited Irrigation Coverage by Written Agreement
2) Limited Irrigation Yield Estimate Application
3) Why Limited Irrigation?

As part of the grant to develop the RMA Documentation Tool awarded in 2016, the KWO was also tasked with increasing awareness of crop insurance options in western Kansas. The expansion of the Limited Irrigation Crop Insurance Program was taking place during this time, so the KWO began educating producers who would experience limited water resources in the near future about available crop insurance options (RMA, 2016). To achieve this, the KWO offered educational training on the Limited Irrigation Crop Insurance Program and how the RMA Documentation Tool could assist producers with reduced water planning. During January and February of 2017, six water conservation and limited irrigation educational events were held. It was noted that the events were dispersed throughout Kansas where the limited irrigation crop insurance would be available. Over 400 attendees were recorded at these events to learn more

[2] The RMA training materials are available on the Topeka RO website.

about the Limited Irrigation Crop Insurance Program and its goals. One of these trainings was held on February 14, 2017 in Garden City, Kansas covering topics that included the availability of the Limited Irrigation Crop Insurance Program , an economic study on impacts of conservation, irrigation and water technology farm updates, and regional groundwater levels (KWO, 2017).

Despite, the readily available training documents, the impressive turnout at the 2017 listening sessions, and the significant amount of time at the Kansas sessions spent reviewing tool features, there were several agents who were unaware of the RMA Documentation Tool. These agents stated that had they known this tool was available they would have been more likely to recommend the program to their producers. It is possible that these particular agents may not have attended the 2017 training sessions or began selling crop insurance after these training sessions occurred. Regardless, it is the viewpoint of AgriLogic that a lack of education and outreach is not a major barrier or justification for low participation in the Limited Irrigation Crop Insurance Program.

PROGRAM PARTICIPATION

Obtaining from RMA program data for the existing limited irrigation program in Kansas. The contractor shall analyze this data and provide the results that demonstrate the insurance experience and level of participation.

Despite the offering of limited irrigation written agreements in conjunction with outreach and education, there has been minimal participation by producers. From 2013 through 2016, there were only two limited irrigation written agreements for corn each year and none for soybeans. Beginning with the 2017 crop year, RMA expanded the pilot program in Kansas, offering limited irrigation written agreements to approximately 44 counties for corn and 30 counties for soybeans as depicted in Figure 9 and Figure 10. These locations were selected due to perceived constituent interest and availability of adequate water records. Despite the expanded offerings, for 2017 and 2018, RMA Topeka Regional Office, which governs the pilot area, received only five limited irrigation written agreement requests for corn each year and none for soybeans.

Figure 9. Kansas Counties with Written Agreement Limited Irrigation Insurable Practices for Corn

Source: USDA RMA Topeka Regional Office, 2017

Figure 10. Kansas Counties with Written Agreement Limited Irrigation Insurable Practices for Soybeans

Source: USDA RMA Topeka Regional Office, 2017

AgriLogic requested policy level information, including those with written agreements for limited irrigation, for corn in the 44 counties and soybeans in the 30 counties offering the Limited Irrigation Crop Insurance Program to provide an analysis as to why participation may be low. In an email dated November 21, 2019 from Shawn Beach, a mathematical statistician for the USDA RMA who spearheaded the limited irrigation project, AgriLogic was informed that RMA would not be able to provide information identifying which of the policies were participating in the limited irrigation written agreements. This was also confirmed during a monthly update call on April 13th, 2020. Instead, RMA provided a report of all grain policies sold in Sheridan and Thomas Counties from 1981-2018. These data were categorized as either "target" areas—those within the LEMA—or "control" areas—polices within three miles of the outer LEMA boundaries and within Sheridan and Thomas Counties. These did not specifically identify which had limited irrigation written agreements.

YIELD ANALYSIS

AgriLogic identified seven policies which were likely those insured under limited irrigation written agreements. These included six irrigated corn policies in Sheridan County and one in Thomas County which were insured between 2009 and 2019. These ranged from 95 to 480 acres in individual insured acres and totaled 1,653.5 insured acres in the 2019 commodity year. The associated approved yields ranged from 149 to 238 bushels per acre totaling 324,232 bushels in expected production for 2019. All but one policy exhibited increases in their approved yields from 2018 to 2019. The acre-weighted mean approved yield across all policies was 233 bushels per acre for 2019. The rate yield, or average yield, over the 2009 to 2018 period for almost all the policies was approximately equal to the approved yield. One policy, identified as Sheridan C, did have a rate yield that was only 54% of the approved yield.

Based on a comparison of the average of the yields for the prior four years beginning in 2013 and going through 2020, almost all policies are exhibiting constant to increasing mean yields over the period. As shown in Figure 11, the prior four-year mean for each policy appears to be generally increasing for most years except for the latter two years of Thomas A. Since 2013 marked the period in which irrigation water usage was to be curtailed for these policies, it might have been expected that yields would have trended downward to some degree, but this does not appear to be the case. For whatever reason or reasons, be it adjusted management practices, a change in planted corn varieties, a generally favorable year-to-year weather pattern, etc., it does not appear that irrigation limits negatively impacted actual yields over this period.

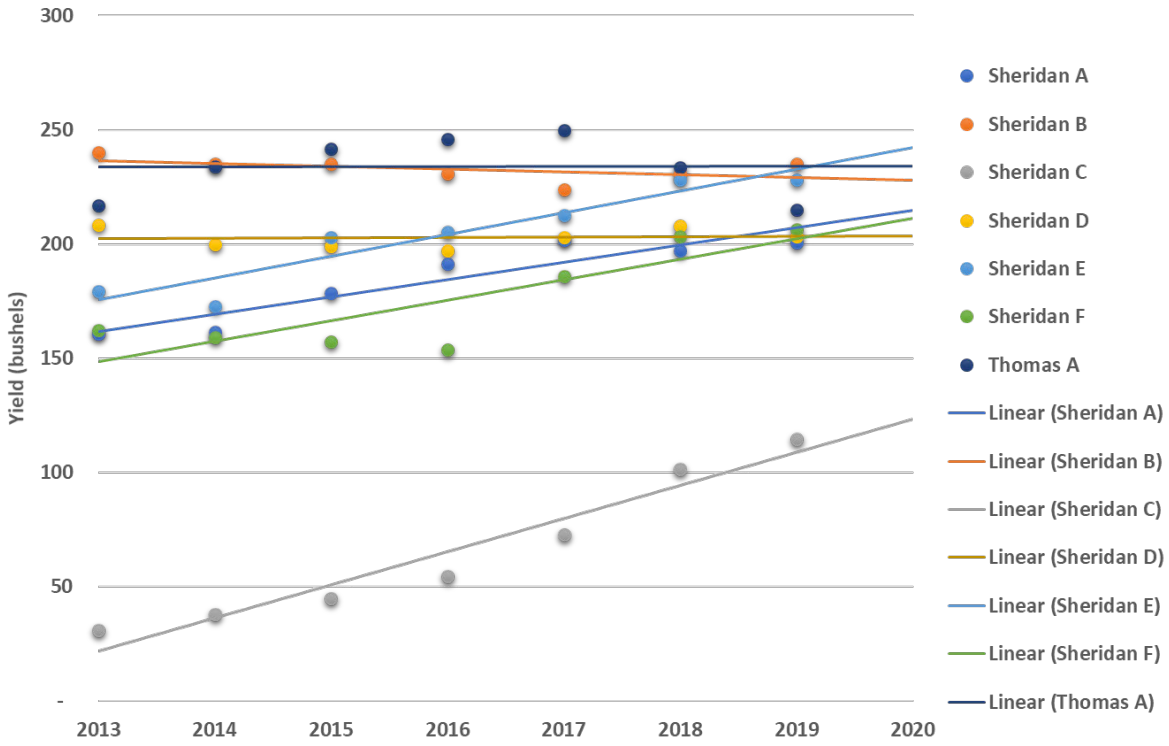

Figure 11. Prior Four-Year Average Yields for Corn Policies Likely Insured under Limited Irrigation Written Agreements, 2013 to 2019

Source: USDA RMA, 2020

The contrast in yields between the control and target areas for corn is demonstrated in Figure 12. Control and target yields are shown for irrigated corn in both counties. Of the yield series, all but the control area in Thomas County seem to vary together for the most part. Trend lines for the three series that tend to covary exhibit very similar year to year changes and expected yields. The target area in Thomas County does exhibit both a higher relative yield in 2017 and a lower yield in 2018. This is also the area in which yields dropped notably from 2012 to 2013 when the LEMA regulations were put in place. Yields in the control area in Thomas County are consistently higher than those for the other counties in all years but 2017. The results of additional analyses of insured corn production in Sheridan and Thomas Counties can be found in Appendix B.

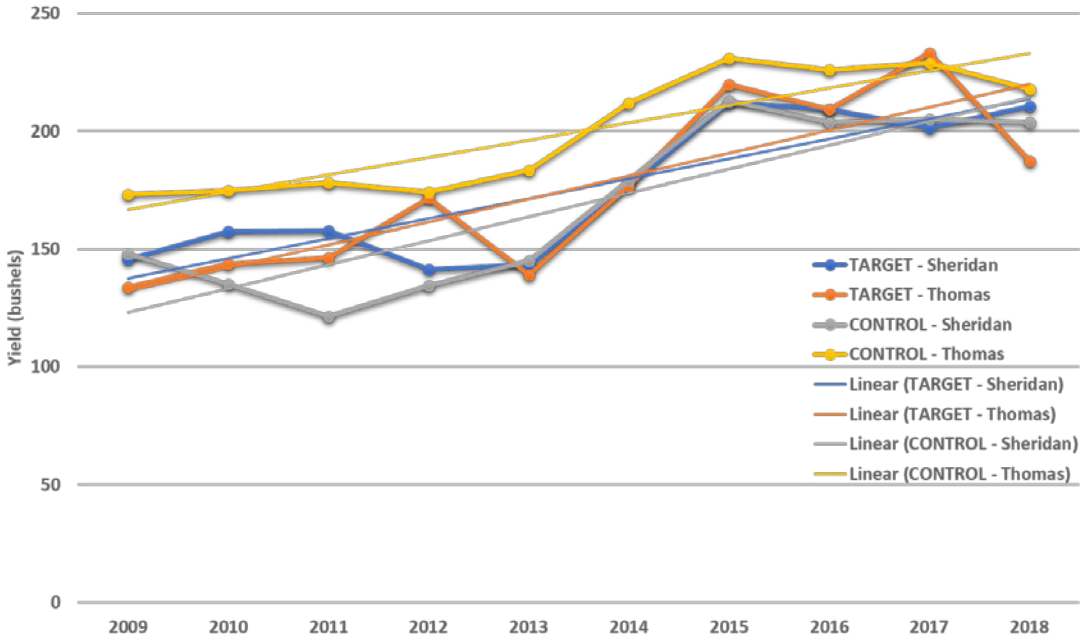

Figure 12. Annual Average Irrigated Corn Yields for Sheridan and Thomas County, Kansas Control and Target Areas, 2000 to 2018

Source: USDA RMA Insurance Experience, 2019

As demonstrated in Figure 13, production of soybeans reached a record high for Sheridan County in 2018, both inside the LEMA and in the control areas. This can likely be attributed to favorable weather patterns discussed later in this section. No production of soybeans has been reported within the LEMA target area in Thomas County since 2000. When comparing target and control areas in Sheridan County, the linear trend lines indicate higher relative expected yields for the control area since the implementation of the LEMA regulations. The expected differential in yields between the two areas is less than 5 bushels per acre in 2018.

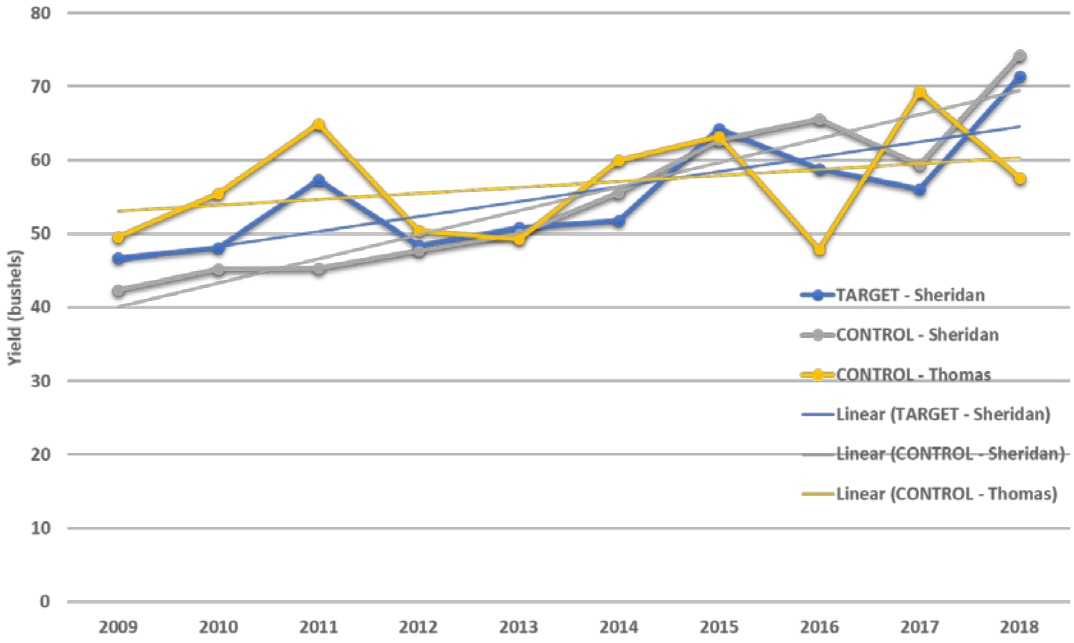

Figure 13. Annual Average Irrigated Soybeans Yields for Sheridan and Thomas County, Kansas Control and Target Areas, 2000 to 2018
Source: USDA RMA Insurance Experience, 2019

WATER USAGE AND YIELD

RMA provided water rights information associated with specific policies in the insurance experience data for irrigated production in Sheridan and Thomas Counties. For certain policies, the policyholders or landowners' water rights identification numbers were provided that were linked to the RMA Documentation Tool database. The cross references between the policy numbers and the water rights numbers are linked to assist in evaluating water use. The reported acres provided in the tool represent the water right holder's annual acreage by crop for each unit. Given certain factors such as share percentage and actual final planted acres, these may not be equal to the acres reported in the insurance filings. It is also unclear whether producers consistently entered information on a single crop basis, and, if crops were aggregated, what the acreage breakout by crop was for each year. Regardless, the resulting database provides insight into the change in water diverted for irrigation over the period in which the LEMA regulations were enacted.

If the policyholder data and associated water rights information are both correct and representative of the Sheridan area LEMA, then water used for irrigation has generally been declining over the last several years. The total reported water diverted that can be associated with crop insurance policy data is shown in Table 2. From 2006 to 2017, the total water diverted has exhibited a downward trend in use even though the total acres associated with the water rights diversions has been relatively constant. Assuming both the reported water and reported acres are reasonable gauges of actual water applied and actual acreage planted, then both the

water applied and 5-year average water applied exhibit notable downward trends. Because of higher relative annual water use in 2012, the average annual change in water use prior to 2013 was nearly zero. Since 2013, and in part due to the notable change between 2012 and 2013, the average annual change in water use has been a reduction of approximately 1.5 inches.

Table 2. Water Rights Diversions Associated with Irrigated Corn Policies Insured in Sheridan and Thomas Counties, Kansas, 2006 to 2017

Year	Reported Total Water Diverted (Acre-Feet)	Reported Total Acres	Water Applied (Inches)	5-Year Average Water Applied (Inches)
2006	4,060	3,426	14.2	16.3
2007	4,990	4,078	14.7	15.6
2008	4,685	4,298	13.1	14.9
2009	3,418	3,797	10.8	13.6
2010	3,655	3,589	12.2	13.0
2011	3,623	3,413	12.7	12.7
2012	4,311	3,327	15.6	12.9
2013	2,609	2,998	10.4	12.4
2014	2,673	3,280	9.8	12.1
2015	1,834	2,864	7.7	11.2
2016	2,514	2,829	10.7	10.8
2017	2,487	3,790	7.9	9.3

Source: USDA RMA Insurance Experience, 2019; RMA Documentation Tool for Limited Irrigation, 2020

The next consideration is to view water usage in context of seasonal precipitation. Precipitation data were acquired for weather grids[3] associated with the physical coordinates of the water rights information (NOAA CPC, 2020). Daily precipitation amounts between the months of April and October for each year were accumulated to gauge the approximate seasonal precipitation. This information is summarized in Figure 14. Comparing the five years prior to the 2013 LEMA implementation and the five years during the LEMA (2013-2017), annual growing season precipitation has varied between 10.5 inches in 2012 to 26.2 inches in 2009. The average annual growing season precipitation from 2008 to 2012 was 19.7 inches while the average dropped to 17.6 inches from 2013 to 2017.

[3] Weather Grid 23218, with center coordinates of -100.625 longitude and 39.375 latitude, was used as a basis for precipitation information due to the centroid proximity of this grid with the coordinates of the majority of water rights locations associated with insurance policies.

To estimate the irrigation water applied for a given acre within the Sheridan LEMA, the RMA policy data was used in conjunction with RMA Documentation Tool to evaluate individual operation water diversion as allocated across the corresponding acres represented. Based on the net insured acre-weighted average of inches of irrigation water applied, it was estimated that mean irrigation water ranged from 3.8 inches in 2015 to 9.1 inches in 2012. These averages appear to be lower than those represented in other data sources in the area, but since these are based on the producer-entered values associated with each policy, there is no adequate stance on which to test questions of validity. It could be that water was not allocated across all the reported acres listed and/or the grower just accepted the acreage amounts that were populated by the documentation tool. Reporting issues notwithstanding, the average irrigation usage shown by these data was 7.1 inches before 2013 and 5.1 inches for 2013 to 2017. As Figure 14 illustrates, the average total water available for 2013 to 2017 was just over 4 inches lower than that of the prior years due to the reduction of average precipitation and average irrigation water use. Irrigation water as a percent of total water available spiked in 2012 at over 46% with a low of 16% in 2008. Given that irrigation water applications compliment seasonal precipitation, it is difficult to disentangle restricted water use from the intervals of necessary irrigation supplementation. That stated, even with lower average precipitation, average irrigation water as a percent of total growing season available water did drop from 28% to 23% between the two periods.

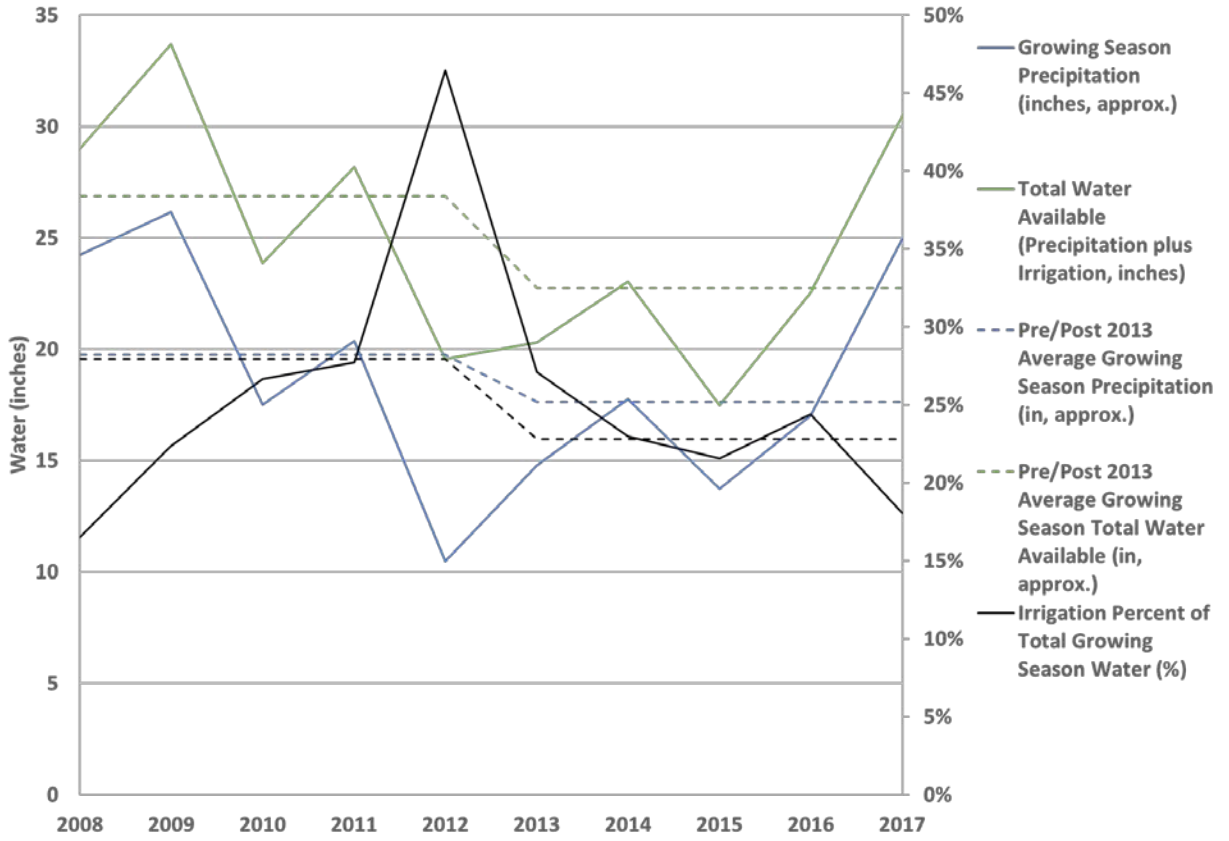

Figure 14. Spring Growing Season Water Availability for Irrigated Corn Policyholders in Sheridan and Thomas Counties, Kansas, 2008 to 2017

Source: USDA RMA, 2020; NOAA CPC, 2020

A final analysis in the water usage and yield discussion includes the relationship between total seasonal available water and the net yields in each year. Despite the availability and timing of water, there are several factors that can influence yields on a given farm. Some have been mentioned in this report and can include production perils, crop varieties, growing degree days, management of chemical applications, etc. Regardless, it is instructive to evaluate the empirical relationship between estimated available water during a growing season and the resulting yields even if these additional factors cannot be held constant.

In conclusion, using a combination of the RMA policy data, the RMA Documentation Tool, and the NOAA precipitation information, yield and precipitation data were extracted from the various sources and aligned. Of the available information, 354 policy-years of yield, precipitation, and irrigation observations were examined spanning from 2006 to 2017. A regression analysis was conducted on the yield observations to examine the impact of variations in precipitation and irrigation before and after the 2013 LEMA regulation implementation. A summary of the regression and brief explanation are provided in Appendix B. As expected, the most significant factor was annual precipitation. Even so, the pre/post 2013 comparisons yielded ambiguity when considering changes in average precipitation and irrigation over the two periods. Evaluating only

the mean yields over the respective periods, the yields for the latter period are 4.7% higher than the pre-2013 period. When evaluated at the average annual values for each factor, the precipitation, irrigation, and pre/post 2013 factors only impacted departures from the overall mean yield between -12 and 12%. As with other aspects of these comparisons, the conclusion is that the net impact of limited irrigation was difficult to separate from other yield influences.

PREMIUM COMPARISONS

A comparison of premium rates was conducted for insuring corn in Sheridan County, Kansas. Liability, total premium, and producer premium were calculated for 75% Yield Protection (YP) coverage on 100-acre optional unit policies of corn grown for grain. Additional premium calculation data are provided in Appendix B Table 2. The producer premium in dollars per acre as well as dollars per $100 of liability are shown in Figure 15 for a range of approved yields under both irrigated and non-irrigated practices. The producer premium per acre—shown by the solid lines—is both significantly higher and steeper moving from lower to higher approved yields for non-irrigated practices. The reference yield for non-irrigated production is 75 bushels, so the expected range of production for most non-irrigated operations is from about 37 to 111 bushels. The reference yield for irrigated practices is 191 bushels, and the associated expected range of production is from 96 to 287 bushels. The producer premium per acre for both practices is between $20 and 25 at the respective reference yields.

Premiums associated with non-irrigated practices rise sharply once approved yields begin exceeding 100 bushels. This is partly due to the increasing value per acre associated with higher yields, but it is also due to the fact that the floor of the non-irrigated producer premium rate is around 7.2%. The maximum non-irrigated rate is about 12.7%. By way of comparison, the producer premium rates for irrigated practices ranges from 2.5 to 3.8%. The producer premium amount in dollars per $100 of liability—shown by the dashed lines in Figure 15–reflects the fact that there is a much wider range of possible outlays associated with non-irrigated practices relative to those of irrigated practices. This is due to the exponential adjustments made on the relative yield for each practice based on insurance experience. This non-fixed portion of the premium rates reflects much higher relative variability in risk associated with non-irrigated practices. Even across a wide range of approved yields, the change in producer premium per $100 of liability is less than $2.

Without any rating adjustments or considerations of premium subsidies specifically attributable to potential limited irrigation practice designations, the actuarial rates associated with those practices would naturally fall between the irrigated and non-irrigated practice rate curves. Based on the Sheridan County example, it is unclear what degree of the attributes of the two respective curves the limited irrigation practice curve would reflect. As some of the other analyses in this report suggests, perhaps the rates would be very similar to those of the irrigated practices, and they would ultimately just be slightly higher than but parallel to the irrigated practice curve. If, as one might expect, the limited irrigation practice reflects a higher relative risk across the range

of approved yields, then the rate curve would be higher and steeper than that of the irrigation practice curve.

Two of the primary insurance criteria are potentially impacted by a producer switching from a full irrigation to a limited irrigation practice: absolute yield and relative yield variability. Although not fully evidenced by some of the analyses in this report associated with comparative yields under reduced water usage due to several potential confounding factors, it is expected that yields will decline as less irrigation water is utilized. Additionally, it is expected that yields will vary more for limited irrigation relative to full irrigation. If a producer under a limited irrigation production regime has the opportunity to insure under an irrigated practice, or a potential new category of limited irrigation, a cost-minimizing approach would incentivize that producer to prefer to remain categorized as irrigated. If the approved yield would remain the same under either scenario but perhaps decline to some degree over the years, the rates associated with the limited irrigation practice would at some point increase above that of the irrigated practice. Considering less water use leading to lower average yields over time, a cost-minimizing producer would seek to keep insurance costs lower under the irrigated practice for the same value associated with the guarantee.

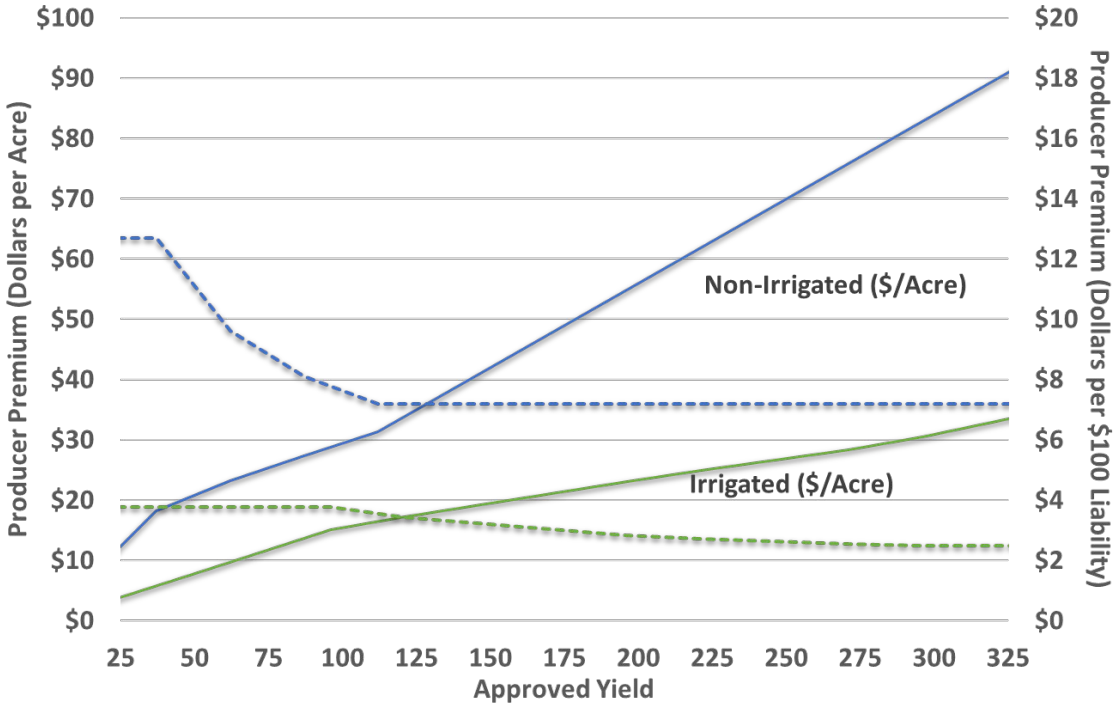

Figure 15. Producer Premium for 75% Coverage based on Approved Yields for Irrigated and Non-Irrigated Corn in Sheridan County, Kansas in 2020

Source: USDA RMA Actuarial Information Browser, 2020

CONCLUSION

Although in the context of innovative water conservation efforts, the Sheridan 6 LEMA has proven to be one of the most successful programs anywhere in the U.S., there is widespread agreement that the Limited Irrigation Crop Insurance Program offered in this area did not have the desired outcome in terms of producer participation and impact. Sheridan 6 was successful in large part because of the leadership by local producers in the innovative development of the LEMA framework and the strong partnership between the producers, Northwest Kansas Groundwater Management District 4 (GMD4), and the state of Kansas. Considering the cooperation that existed at the local, area, and state level, there were initially high expectations for the Limited Irrigation Crop Insurance Program, but in hindsight this program has not induced substantial producer involvement as evidenced by the lack of participation.

AgriLogic has identified four primary factors that we believe have contributed to continued low participation in the Limited Irrigation Crop Insurance Program based on research, analyses, and discussions with industry experts. These include:

1) Adaptive location with inadequate incentives;
2) Indistinctness due to weather patterns;
3) Unclear standards; and
4) Administrative management.

These will be discussed in detail in the subsequent sections.

ADAPTIVE LOCATION WITH INADEQUATE INCENTIVES

The role that producers played in developing the irrigation restrictions for Sheridan 6 led many of them to believe from the beginning that they could adjust to utilizing less water without drastically impacting their farm level economic circumstances. Dr. Bill Golden, an agricultural economist with Kansas State University, has been a long-time partner of the GMD4 in evaluating the economics of water conservation for the district. Dr. Golden predicted, that, before the Sheridan 6 restrictions were implemented, producers could still be successful with the new restrictions by adopting new technologies and changing their field-management practices (Walton, 2013). Dr. Golden developed a research approach to account for many of the factors at play for a given year by comparing planting decisions made by the Sheridan 6 producers to those of their neighbors over a five-year period from 2013 to 2017. His findings related to the Sheridan 6 production area were:

- Reduction in irrigated corn acreage by 22.9%;
- Increase in irrigated grain sorghum acreage by 400.8%;
- Increase in irrigated wheat acreage by 87.2%;

- Producer reported data for the 2013 through 2016 crop years indicate irrigated corn producers within the LEMA boundary (both those with and without the limited irrigation written agreements) used 23.1% less groundwater, while only yielding 1.2% less corn as compared to irrigated corn producers outside the LEMA boundary;
- Somewhat surprisingly, irrigated corn producers within the LEMA boundary reported 4.3% more cash flow than their higher yielding counterparts outside the LEMA; and
- Producers that grew irrigated grain sorghum inside the LEMA boundary applied an average of 4.1 inches per acre, 60.5% less groundwater, yielded 13.8% less grain, but generated 59.9% more cash flow than their counterparts outside the LEMA (Golden, 2018).

An econometric estimate concluded that most of the budgetary savings were achieved through a reduction in the level of water use given the same cropping patterns. The study also noted there was a small but significant reduction in water use due to changes in cropping patterns (Drysdale, 2018). Mitchell Baalman, a producer in Sheridan 6, also noted the importance of no-till methods and efficient use of fertilizer and seeds stating that these practices have led to LEMA producers being better managers and that the uncertainty of weather has caused them to oversee their water use differently (Water + Energy Progress, 2013). The 20% reduction in water available to producers, while significantly less than before the regulations were adopted, did not have a negative impact on yields or profits. Producers in Sheridan 6 are to be commended for their proactive change in farming and irrigation practices to reduce their water use and remain profitable compared to their neighbors who did not have the same restrictions. However, based on research and comments from producers, Sheridan 6 is a unique production area of Western Kansas due to having better soil, more ideal weather conditions, and producers who have elected to be proactive in their management strategies as compared with other areas of Western Kansas.

The differences between soil profiles along with weather patterns, which will be discussed later in the report, are two factors that can lend to relatively stable producer yields in the LEMA. Different soil types have been credited with varying yields and water use efficiency based on each soil's water and nutrient holding capacities. In general, non-sandy soils can vary from medium to fine texture and allow for greater water holding capacities, allowing plant roots to pull water for a longer period. In comparison, sandy soils lose much of their water to gravitational pull resulting in a lower field capacity. In the map overlay shown in Figure 16, yellow areas mark greater than 60% silt content areas while dark blue areas exhibit high sand content areas. Sheridan and Thomas Counties have a relatively high silt and clay content, while Finney and Kearny Counties have the highest concentration of sandy soils in Western Kansas. These latter two counties exhibit some of the lowest water holding capacities in the state.

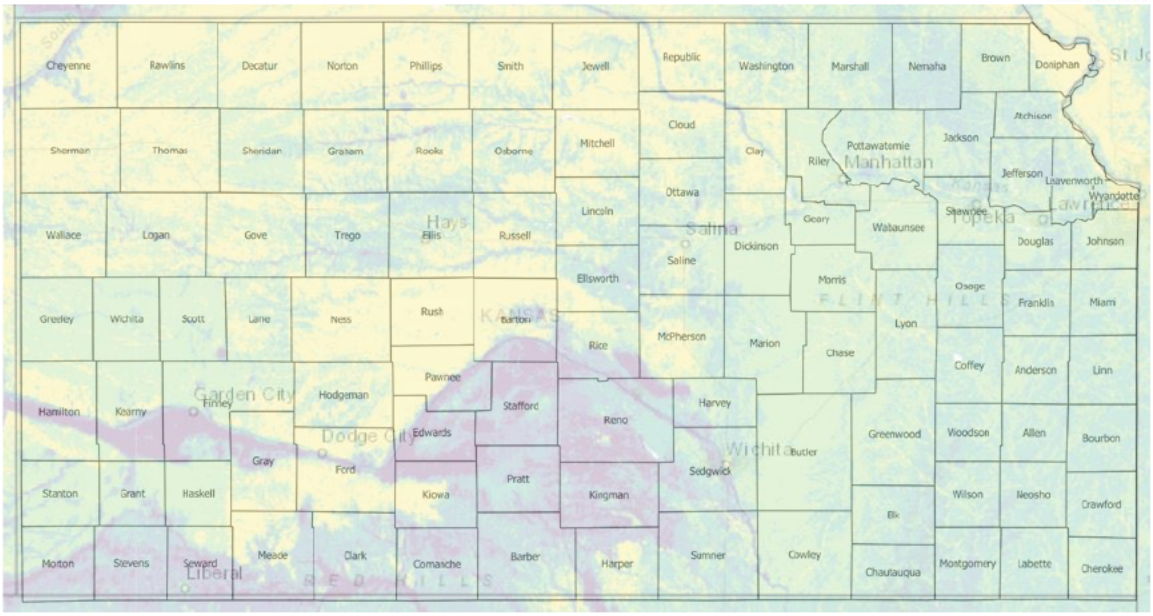

Figure 16. Silt Soil Content Map

Source: UC Davis, 2020

As discussed above, producers in the Sheridan 6 LEMA, except for the few who selected the limited insurance option, have been allowed to continue with a fully irrigated policy as they have implemented irrigation management practices that have allowed them to continue to achieve yields consistent with their approved yields for an irrigated practice. Producers have also generally been able to maintain net profitability despite water restrictions using careful water management, changes in cropping practices, and improved farm management practices. The fully-irrigated policy provides a higher APH and lower base premium rate relative to other practices resulting in similar producer-paid premiums for fully irrigated and limited irrigated as shown in Table 3. A combination of these factors has likely resulted in a lack of incentives for most producers to select the Limited Irrigation Crop Insurance Program.

Table 3. Example Comparison of Insurance Guarantees and Premiums between Irrigated, Limited Irrigated, and Non-Irrigated Corn

Insurance Calculation	Irrigated Corn	Limited Irrigated Corn	Non-irrigated Corn
APH yield bu/acre	187	161	55
Coverage Level	x 0.70	x 0.70	x 0.70
Bushel Guarantee	131	113	39
Projected Price	$3.86	$3.86	$3.86
Insurance Guarantee	$505	$435	$149
Premium Per Acre	$26	$24	$23
Producer Paid Prem./Acre	$11	$10	$9
Base Premium Rate	5.15%	5.52%	15.44%

Source: USDA RMA Topeka Regional Office, 2017

Indistinctness Due to Weather Patterns

As discussed extensively in the report analysis on water use and yield, weather and related growing season precipitation during intervals of the restriction period may have been factors in the low limited irrigation insurance participation. Regulations on water were set for a five-year period, allowing producers to use 55 inches during this time. As exhibited in Figure 17, precipitation gradually increased throughout the LEMA timeframe, excluding Thomas County in 2016. The red enclosure in Figure 17 represents years in which the LEMA was in place. This rainfall pattern resulted in producers using more water in the initial years and requiring much less irrigation during the final year. This allowed producers to remain under their allocated amount as reflected in Table 2. As discussed previously, these precipitation patterns combined with water use for the year did not ultimately impact producer yields.

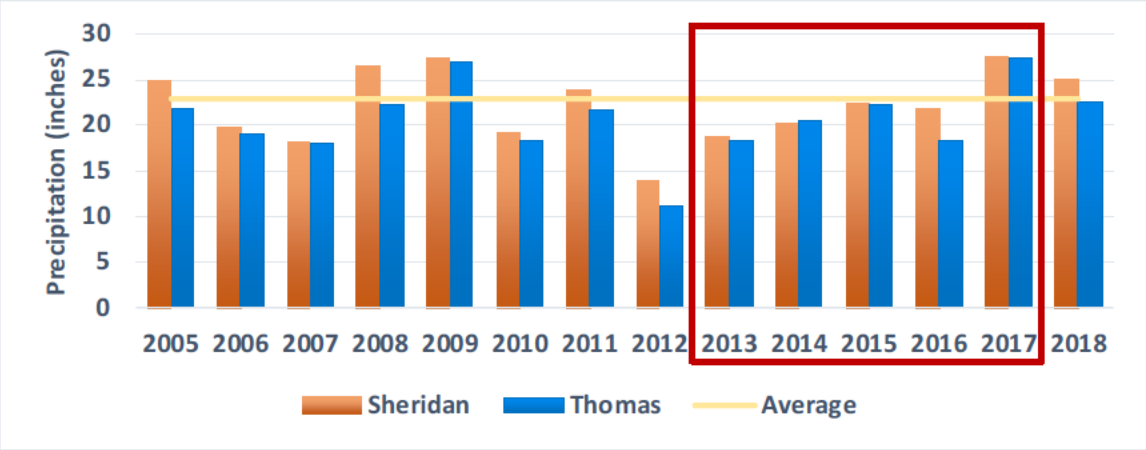

Figure 17. Total Annual Precipitation Sheridan and Thomas County, 2005 to 2018

Source: KSU Kansas Climate, 2020

In a publication by Donald Whittemore, Senior Scientific Fellow for the KGS, radar precipitation was compared to annual water use within the Sheridan 6 LEMA. The significant difference between water usage before and after the LEMA implementation, despite the favorable weather from 2015 to 2018, is shown in Figure 18. By evaluating the water use versus the amount of precipitation for the LEMA area before and after restrictions were established, water conservation was evidently employed. The red line representing LEMA data shows a substantial drop in water usage from the blue line representing pre-LEMA years. By comparing similar water conditions during each time frame, while precipitation did in fact influence the water used within the LEMA, producers still practiced water conservation relying on their water management practices rather than additional precipitation (KGS, 2018).

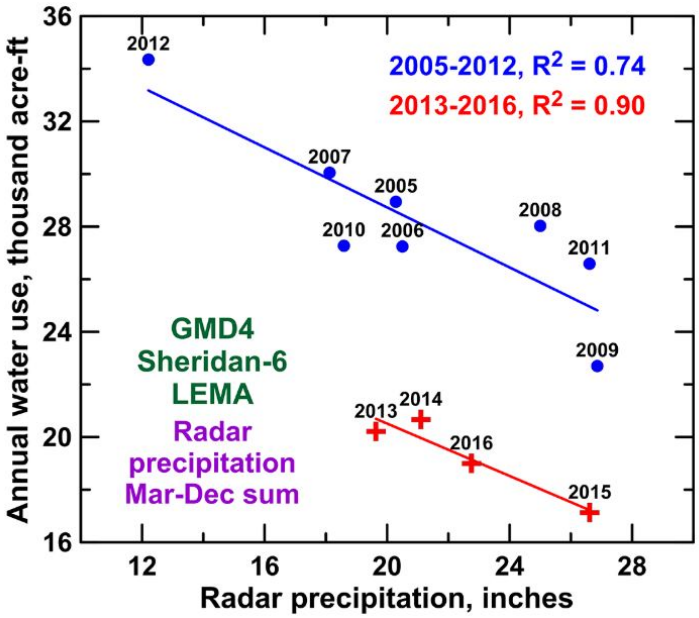

Figure 18. Annual Water Use Versus Rader Precipitation

Source: Kansas Geological Survey, 2018

UNCLEAR STANDARDS

Extensive rules and regulations for the limited irrigation practice were developed by RMA. There has, however, been some difficulty in the interpretation and implementation of these procedures for every situation. Irrigation guidelines are recorded in the Document and Supplemental Standards Handbook (FCIC, 2020) that states:

It is important that these guidelines be utilized to document whether, at the time insurances attaches, there is a reasonable expectation of receiving adequate water to carry out a good irrigation practice for acreage reported under the irrigated practice.

Selected definitions include:

- *Good Irrigation Practice*: "The application of adequate water in an acceptable manner, at proper times, to allow production of a normal crop which is often identified as the approved APH yield for crops."
- *Reasonable Expectation of Adequate Water*: "The insured had no reason to know at the time coverage began the amount of irrigation may be limited or reduced. No reasonable expectation exists if the insured knew, or had reason to know, the amount of irrigation water may be reduced before coverage begins."
- *Determination of Reasonable Expectation of Adequate Water:* "Factors to be considered (applicable to both the AIP and the insured) when determining and documenting whether a reasonable expectation of adequate water existed include, but are not limited to the following: Most recent 10-year historical average of available water and any applicable

forecasting data from a credible authority responsible for monitoring and forecasting such conditions such as Irrigation Districts…"

- *Failure to Qualify or Carry Out a Good Irrigation Practice:* "If the acreage fails to qualify for insurance under the irrigated practice, it will result in such acreage being insured under a practice other than irrigated. If no other practice is available for the acreage, insurance will not be considered to have attached on the acreage."

Similarly, for limited irrigation, RMA documentation implies that in order to meet limited irrigation practice guidelines, "a producer has to have enough water to deliver the right amount of water at the right time to produce the yields on which the agreement is written" (RMA, 2018).

However, this does not specify what qualifier must be met for the producer to meet limited irrigation requirements in the first year in which he/she is moving from a fully irrigated practice to the limited irrigation practice. It only specifies how to maintain the threshold once the limited irrigation practice is being participated in.

Since the pilot program did not include a specific threshold or criteria when a producer would be ineligible to receive coverage as fully irrigated, it is possible that some producers in Sheridan 6 may have continued with a fully irrigated policy when they should have seriously considered the option of a limited irrigation practice. As a result, their irrigated practice yields for the specific insurance units are already reflective of the limited water availability to a significant degree since the decline has been gradual over an extended period. Current irrigation guidelines place a strong emphasis on past irrigation history and consider forecasts of water conditions by credible authorities, but the application of interpretations of this can vary (even between an insured's wells providing water to an insured unit). The concern is that current guidelines may allow producers with a more rapidly declining APH yield (because of reduced water) to continue with a fully irrigated practice when that may not be appropriate depending on the water situation. A more definitive procedure in implementing the limited irrigation practice requirements would be of value in making it more transparent to insureds as to when they should convert from a fully to a limited irrigation practice. However, the ultimate driver we believe should be on the economics of optimizing the long-term financial stability of their operation.

Administrative Management

According to comments made at listening sessions, paperwork and bookkeeping, specifically the written agreement process, while not the only culprit, may have been another factor contributing to fewer producers and their agents taking advantage of the Limited Irrigation Crop Insurance Program. Written agreements require additional steps and paperwork, hence additional administrative burden, for both the producer and the agent. In conclusion, while the written agreement process in and of itself is not likely a major hindrance to program participation, AgriLogic would surmise that when considered in addition to the other grounds listed above, it does seem to be a contributing factor to the overall lack of participation. Several strategies for

RMA to consider, which could result in potential increased efficiency and minimized administrative tasks in this area, are provided in the Recommendation section of this report.

SUMMARY

Although the program offering has not had the desired outcome does not mean it is impossible to design a program that will be effective for producers. Crop insurance is not normally thought of as a tool for water conservation, but crop insurance policies do impact producers' decisions about water management. The biggest overall issues with crop insurance as it relates to irrigation is the lack of a policy that meets the needs of producers who do not have the capacity to meet the requirements of a fully irrigated policy but are in a position to apply some level of irrigation water. Although producers' water resources may be limited, they are likely in a far better situation in terms of potential yields and production risks than non-irrigated producers. This situation is the reason that the Limited Irrigation Crop Insurance Program was developed initially and continues to be a valid need especially in areas where water is becoming more limited.

To survive and be competitive in today's agricultural environment, producers are required to use a higher level of management and conservation of all resources than ever before including water resources. State and federal government entities are placing an ever-increasing emphasis on developing programs and policies that support and incentivize water conservation. Crop insurance greatly impacts producer behavior in terms of the conservation and management of water resources. The issues around irrigation and crop insurance are only going to grow in importance and it is increasingly important that RMA continue to develop an irrigation policy for the new realities of agriculture including being an integral part of developing tools that meet the new and emerging challenges in water resource management.

The objective and strategy behind the Limited Irrigation Crop Insurance Program were obviously a great step forward in recognizing the need to contribute to the sustained water levels of the Ogallala Aquifer and the success of farmers as they transition into a reduced water supply and greater restrictions on water use, both now and in the future. However, more than minor changes are needed in order to have a viable option for producers who find themselves in a mandatory or voluntary reduced water situation. Important lessons can be learned from the existing program and will contribute to the design of the recommended program modifications provided.

Among the provisions that should be considered and continued are:

1) Limited irrigation should be established and maintained as a separate practice. Requirements should consider the different water requirements applicable for different crops as previously noted as well as the yield model discussed in the Recommendations section of the report. Producers would be required to keep a separate APH data base for their limited irrigation practice. Also, several years of insurance experience would be valuable in determining what modifications may be needed in the program. Improving the program over time will require monitoring of the program and input from the advisory

committee of producers and others. In addition to the APH for limited irrigation practice a producer may also have some acreage insured as fully irrigated. As an example, a producer may plant fewer acres at a specific location, permitting insurance as a fully irrigated practice. In cases such as this, the producer would need to maintain separate APH databases for each practice.

2) Written Agreements have received considerable push back, but this process also has important advantages, primarily potential flexibility in providing an insurance offering tailored to the needs of an individual producer. For instance, some producers may be able to demonstrate their ability to exceed the standard output from the model and perhaps that could be considered. Factors that influence a producer's ability to utilize water are unique for each farm and also vary from year to year. These variables include the soil characteristics (water holding capacity), variety differences (response to water or lack of), tillage practices (cover crops and reduced tillage), irrigation system (pivot or subsurface drip) and producers' expertise with technology for water management including tools for monitoring plant stress, soil moisture, remote control of irrigation, and irrigation scheduling tools. Until such time as there is enough experience and participation in a program, it would be difficult to publish limited irrigation as a standard practice, although this would be the ultimate goal. In the meantime, written agreements should be utilized to allow flexibility in the program.

The following are specific examples why it is advisable for RMA to continue offering an effective program for scenarios in which producers have limited irrigation.

1) *Producer Interest* - Producers and insurance agents at the listening sessions suggested that some type of Limited Irrigation Crop Insurance Program should be available because the water supply issues, particularly for the Ogallala Aquifer are only going to become more severe in the future.
2) *Need* - In addition to the Kansas Water Office and the Kansas Department of Agriculture, several water districts have indicated a need for this type of program. As an example, the Southwest Kansas Groundwater Management District 3 (GMD3) stated in the latest draft of their groundwater management program: "Risk management is a key influence of the farm bill on the district groundwater program activities. Input and potential partnerships with RMA and others will be encouraged to further develop useful risk management products for limited irrigation and supported to limit unnecessary irrigation in declining groundwater areas." (Revised Groundwater Management Program, Southwest Kansas GMD No. 3, draft on February 2020)
3) *Flexible Insurance Offering* - Current insurance programs only offer actuarial options for irrigated and non-irrigated policies. There is a definite need for an in-between policy option for areas facing a declining and limited water supply for irrigation.
4) *Collaborative Support* - The state water plan for Kansas has as one of its statewide action items to address crop insurance policies, such as limited irrigation, that support water conservation goals.

RECOMMENDATIONS

Based on the findings of this study, it is AgriLogic's recommendation that RMA continue its Limited Irrigation Crop Insurance Program with the following redesign to better suit producers in western Kansas on a pilot basis. For the purposes of this report the "refined pilot program" refers to the recommended changes that would be implemented to increase participation in these areas. It should be mentioned that these recommendations are made with a proactive stance as you will not likely see a broader adoption until more severe regulatory restrictions or environmental conditions are observed in the future. The redesigned program, at least for the near term, should continue to focus on groundwater and include these components:

1) Continue to offer program in current locations;
2) Accounting for weather and improving yield curve estimates;
3) Enhance participation through insured specific economic assessments;
4) Improved administrative management; and
5) Formation of local advisory committees for industry expertise.

CONTINUE TO OFFER PROGRAM IN CURRENT LOCATIONS

We recommend the pilot program continue to be offered in the existing locations, but with the refined methodology discussed in this report. Due to the significant value that the concept has for specific circumstances along with the extensive overall investment already made in implementing it, we believe it can be a useful tool for the future if the suggested enhancements are adopted. An expansion beyond Western Kansas is not recommended at this time until modifications are implemented that lead to a broader adoption in the area(s) for which it is best suited. In other words, location choice is the most critical aspect to review before considering expansion of the concept.

The current pilot program encompasses the area with the most extensive database of historical water use on the insurable unit level of any state in the region, with an emphasis on ground water as the primary irrigation water source. However, the Sheridan 6 area may not have been the most indicative of the true value of the program due to the soils in that area that exhibit a stronger water holding capacity than many other areas in the pilot. Favorable weather patterns in recent years for the area, coupled with many insureds in the broader crop insurance program taking a more proactive approach in advanced irrigation management techniques, have led to more water efficient operations. Due to the insureds being more water efficient, they have still been able to achieve yields comparable to their irrigated production practice history since the program was introduced. Hence, the Limited Irrigation Program has not been as broadly adopted as anticipated when it was developed. This does not indicate that there will not be a future need for the program in this area or that it has not been benefited participants in its current form.

Not all producers are interested in a Limited Irrigation Crop Insurance Program, but promoting refinements to it, if adopted by USDA, can result a very valuable tool to insureds in areas where it is feasible to effectively operate. Producers who serve as board members of water conservation districts need to be involved in the implementation process, because producer interest and support for the concept will be essential in moving forward with any program modifications. Support and interest by irrigation districts should be considered in implementation as well. GMD4 remains involved in assisting with the program and GMD3 has expressed interest in helping test such recommendations as well.

In addition to potential interest, there are several conditions related to the water supply situation that would be important to consider for implementing changes. Areas that are experiencing a significant decline of the water table with irrigation districts considering restrictions on water use are more likely to have stronger participation in the program with the recommended changes. Many producers are aware they are on a path to eventual dryland production unless usage is based on available water supplies, alternative crops, and more intensive crop production on fewer acres and monitored irrigation practices. Areas that already have local water restrictions in place are not necessarily essential to program success but may be considered the most opportunistic as the program is being refined and tested.

In the future, if a refined program is significantly adopted by insureds and it performs well from an actuarial perspective, it could be considered for expansion into other areas of Kansas and other states. Nebraska and Colorado, for example, as compared to Kansas, generally rely more on surface water as a source for irrigation. Surface water has some special challenges from a crop insurance standpoint. This is primarily due to the greater degree of uncertainty from one year to the next compared to groundwater. River flows and timing are less predictable than ground water resources.

Accounting for Weather and Improving Yield Curve Estimates

There are serious questions about the premise of using any model to make a final determination about crop insurance coverage for a producer. Models are projections based on the data supplied to the model. The UNL Yield Adjustment Table raises concerns as to its appropriateness for several reasons. To accurately reflect current local conditions, water yield models need to consider a larger number of variables that are at best challenging to model. According to a review, drastic variances occurred in the Garden City, Kansas area due to seasonal changes, changes in evaporative demand, and cultural practices (Rudnick et al., 2017).

In 2013 RMA contracted with Watts and Associates to conduct a Limited Irrigation Feasibility Study. This study focused on several issues with the UNL model and the crop production functions were discussed. Below are the major issues that were identified in the report:

- Data for limited irrigation was not abundant at the time and relied mostly on trial plots that do not reflect the current situation;

- Management practices and precision agriculture strategies were not considered; and
- Producers did not agree with the model (Watts, 2013).

In addition to this study, Jonathan Aguilar, a Kansas State University engineer at Garden City, also noted that the UNL model does not consider differences in soil type or seasonal moisture and the production curve can vary greatly for a dry versus wet year. The UNL model only accounts for three irrigation methods and as water availability continues to decline new methods should be taken into consideration.

Finally, RMA's attempts to work with the model development team to reconcile these issues have not been successful and the model continues to function as originally designed without updates or improvements that are likely needed to ensure credibility and maximum benefit. It is AgriLogic's understanding that the model is no longer being updated and that the creators may no longer be functioning in the same career capacity as when it was developed. Summarily, the UNL model was a good first step as a tool for a Limited Irrigation Crop Insurance Program ; however, for it to be truly reflective of the situation in Kansas and for producers to trust the model, it must account for these additional factors that contribute to yield curve formulation.

Several models like the UNL model attempt to develop production functions for a large area, but the actual production functions can vary drastically within a small area. Factors impacting the production function include soil characteristics, use of cover crops and other farming practices, as well as the response of different varieties to water. While it is not easy to develop an accurate production function, they have the potential to be more accurate if developed for a specific area.

The Crop Water Allocator (CWA) model developed by Jonathan Aguilar uses the Kansas Water Budget (KSWB) and considers additional crops common in western Kansas, crop rotations, soil water availability, and irrigation efficiencies. The use of the KSWB is highly regarded by experts as it uses average daily values from 30 years of in-depth weather data that tracks changes in climate, including maximum and minimum air temperature, solar radiation, and precipitation (Drysdale, 2020). Conversations with the Kansas Water Office and Kansas State University personnel indicated that multiple datasets were used to create a 30-year baseline that the KSWB was created from. This baseline is also used as a comparison when evaluating climate data. The model not only includes the water production function, but it also covers more crops than the UNL model and accounts for variations in soil type where the UNL model does not. Using land split and water allocation to each crop, the CWA can calculate the net economic return, helping producers make the best decisions for crop management. The tool uses data field location, irrigation, crop information, price per unit and yield per acre to calculate outputs as seen in Figure 19.

The Irrigation Application Efficiency allows the user to determine the actual water amount being distributed into the soil, rather than just the amount pumped. While efficiencies vary, this variable accounts for an infinite number of irrigation methods and can easily be updated as new

and more efficient methods become available. The CWA also accounts for maximum yield adjustments using the following equation:

$$Y_{iu} = Y_{ic} (Y_{mu})/(Y_{mc})$$

where

Yiu = incremental adjusted yield for user yield-irrigation relationship;
Yic = incremental yield-irrigation relationship from Crop Water Allocator (CWA);
Ymu = user entered maximum yield; and
Ymc = maximum yield for CWA yield-irrigation relationship.

When using the tool, the field, location, and irrigation information are input first. Crop prices and maximum yield per acre should reflect the historical information collected for the specific area and irrigation data used. While the tool is specifically designed to be an economic decision-making tool for producers, the model offers potential for use as the basis of a new Limited Irrigation Crop Insurance Program model due to its use of the KSWB and careful consideration of irrigation events applied to annual precipitation. Not only will the model assist in allowing RMA to develop a more effective program but use of the tool itself will help producers make the best water efficiency decisions to help sustain the aquifer, and their livelihood in general.

AgriLogic has concluded that the CWA tool has the potential to be very useful in the proposed pilot program. However, it should be taken into consideration that updates and/or modifications would still be necessary before incorporating the model in a refined pilot program. For example, it needs to be updated with yield data representative of the newer varieties of corn and other crops as well as performing a test of the model under different precipitation and irrigation conditions in the pilot area(s). High level models such as this are more accurate when developed using data for a specific area. The developer, Jonathan Aguilar, is located at the Garden City Kansas State University research and extension center and has indicated via phone call a strong interest in working on modifying the model as a tool for Limited Irrigation Crop Insurance Program. Additional personnel recommended for further modifications of the model are Agricultural Engineers Allen Schlegel and Dr. Freddie Lamm, as well as economists Bill Golden and Dan O'Brien.

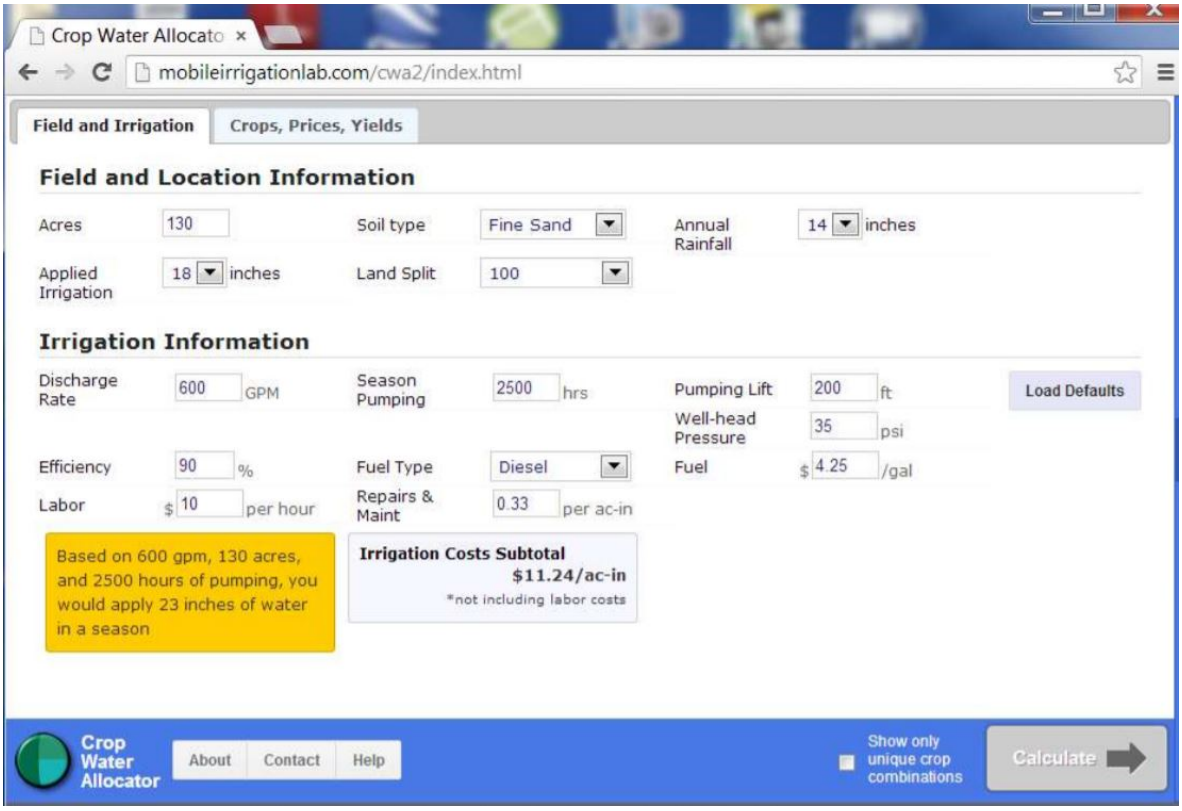

Figure 19. Crop Water Allocator Screenshot

Source: KSU Research & Extension Mobile Irrigation Lab, 2014

However, if RMA chooses to continue to utilize the UNL model—or while a new model is being selected and refined—AgriLogic would ask RMA to consider the modified version of the Deficit Irrigation Template developed by AgriLogic during completion of this project. In lieu of the current format, which uses a lookup table, the modified format allows the producer to enter the state, county, crop, irrigation system, historical water use, and water use reduction. This template could be maintained as a database and updated annually. The spreadsheet was designed to produce a one-to-one relationship between the "RMA Deficit Irrigation Template - Final_.xlsx" results and those in the revised version. Both result in no (or, more precisely, "N/A" or not available) estimated reduction in yield. If the database were to be maintained with numeric fields for the indicated variables, then these would be placeholder values for locations and crops in which one crop (e.g. corn) was available for estimation but the other included crops (e.g. soybean) produce no recommendation. If it is preferred to completely exclude location and crops for which yield reductions are not estimable, then these could be removed from the spreadsheet. The revised template is being submitted as a separate Excel file with this report submission.

ENHANCE LIMITED IRRIGATION PROGRAM PARTICIPATION THROUGH INSURED SPECIFIC ECONOMIC ASSESSMENT

Providing recommendations to encourage producers to carry out limited, reduced, and water conservation practices.

The most effective way to increase producer participation in the program is to provide an incentive for them to do so. Under the current program, there is essentially a disincentive for producers to participate. If a producer chooses to participate, the yield guarantee will be reduced in addition to paying a slightly higher premium rate for the insured liability. Two things are required to provide a positive incentive for participation:

1) The (state and or local water) entity regulating water use must first decide whether to reduce the amount of water available to producers; and
2) There must be an economic incentive for the producer to participate.

The mindset of producers needs to change from maximizing yield to maximizing long-term profitability. This equates to water-use-efficiency in preserving and enhancing their properties' long-term economic values. The Kansas State University Research and Extension Service Crop Water Allocator (CWA) is a valuable tool in demonstrating to insureds that a reduced water utilization may lead to enhanced profitability and moderated risk for their operation. It assists producers in analyzing the most profitable allocation of water among various cropping decisions. This is an area in which university extension personnel could fill a valuable role in educating insureds.

A common example that producers in Western Kansas are facing today is the selection of crops for optimal profitability. Producers must decide if they should change the crop selection to a more water efficient alternative, continue to grow the crop with a higher water requirement under a more limited irrigation methodology (e.g. deficient irrigation), or grow the crop on reduced acreage. This will likely lead to lower yield expectations while optimizing expected profitability, which could be an excellent fit for the limited irrigation production practice. The optimum choice will vary between insureds and potentially from year to year depending on current and expected environmental conditions and commodity prices. While the solution to this issue will not be the same for every producer, a limited irrigation option should be available for those in the areas with serious water limitations. If the insurance program offerings are restricted to solely non-irrigated or fully irrigated production practices, it will miss a significant portion of the insureds' optimal strategies for long-term financial stability.

The extent of producer participation in this program will depend on the accuracy of the production yield curve model, the current and expected weather pattern for a particular year, and the effectiveness of the education and outreach on the refined offering. Crop insurance is not the only factor in a producer's decision, but a limited irrigation option could provide a

valuable tool to those insureds whose optimum profitability model is best suited to a limited irrigation practice.

As previously described, guidelines regarding what constitutes a limited irrigation practice continue to be vague and, in some cases, vary between producers. While AgriLogic recognizes that the current definition of limited irrigation is anything less than what constitutes fully irrigated, having a defined set of procedures that the GMD Board could follow in providing recommendations for thresholds in their region would provide more transparency to insureds as to when they should be converting from a fully to a limited irrigation production practice.

PAPERWORK MANAGEMENT/ADMINISTRATIVE STREAMLINING

Written agreements have the advantage of the flexibility needed initially for implementation of the refined pilot program in order to adequately recognize unique and enhanced characteristics for individual producers. The goal should be to make the written agreement process as streamlined as possible. RMA and the RMA regional office would be responsible for developing the applicable written agreement requirements and approval standards. The RMA regional office and AIP would be responsible for administering the written agreement process.

If it is the goal of RMA to eventually get to a point where a standard limited irrigation practice can be published in the actuarial documents, RMA will need to develop on its own or in conjunction with NASS a limited irrigation yield series similar to the yield series for other crops in the target areas and used to establish insured practices. At this time, this seems possible only if RMA proxies off the existing irrigated yield series for the areas where a limited irrigation practice would be offered. If, on the other hand, the goal is to establish a standard protocol to establish APH yields specific to limited irrigations practices, then an extended period of continued written agreements is needed. If a proxied-limited irrigated yield series derived from modeling or other means is not acceptable, the yields reported under the pilot over time would be the primary means to develop a relevant applicable yield series that could be utilized for both individual producers and those within the same LEMA.

Developing web-based applications, in consultation with RMA, to streamline access to coverage for producers electing to conserve water use on irrigated crops.

AgriLogic sought clarification on what was expected to fulfill the task order requirements pertaining to this item and received the following response from RMA on March 10, 2020:

> *"There isn't anything needed to build from the ground up. However, the report could have suggestions on how to incorporate any suggestions or improvements into the cost estimator for limited irrigation. Given the RMA documentation tool created through the Kansas Water Office grant, maybe suggestion on whether this needs to be in the cost estimator. The yield curves were established for CO, KS, and NE. As for OK and TX, would there be enough information to establish yield curves for those areas, along with water use (i.e. meters) data?"*

According to RMA, the cost estimator for limited irrigation written agreements is the same cost estimator used for all other insurance programs, located on the RMA website[4]. AgriLogic began by understanding the interaction between limited irrigation written agreements and the cost estimator.

The information that is input into the cost estimator would reflect all the typical information required to generate a quote for an irrigated practice, with the primary difference being the entry of the 'expected yield' calculated from the RMA Documentation Tool (Column 27) being used in place of the 'approved yield' and 'rate yield'. RMA stated that the reference yield and rating factors are the same for the limited irrigation quotes as they are for irrigated quotes. It was further explained that no additional yield adjustments (e.g. TA, YA, YC) apply to the limited irrigation quotes. AgriLogic has noted that this is a negative benefit to the producer, since the producer will not be able to get the same benefit on his/her limited irrigation policy as would be available on irrigated or non-irrigated policies in the event of a zero yield, etc. In fact, in an extreme scenario, a non-irrigated yield could be as high as the limited irrigation approved yield due to the exclusion of this adjustment procedure; this protocol may need to be reconsidered by RMA.

The resulting expected yield (e.g. 168 bu/ac) generated from the RMA Documentation Tool, based on a single amount of 'proposed water applied' (e.g. 11 inches) will establish the limited irrigation T-yield for the first four years of the new database, which will be updated annually going forward with the producers' actual limited irrigation yields replacing the T-yields as they are made known. There is no option for the producer to enter multiple years of varying water reduction levels (e.g. stepwise water reduction for multiple years) into the decision tool at this time; in other words, the reduction in water is assumed to be a one-time change that will level off and remain constant until actual yields replace T-yields. RMA stated that if continuing water restrictions required an even more reduced yield estimate (and associated T-yields), a separate database would need to be established to maintain that data. In summary, at first glance, there does not appear to be an opportunity at this time to 'streamline' the cost estimator for limited irrigation written agreement policies and AgriLogic believes that the cost estimator and resulting premium quotes are functioning at the most efficient level possible, considering the way the policies have been designed.

AgriLogic then sought to review the RMA Documentation Tool itself. The tool is user-friendly and self-explanatory with the exception of several fields. For example, Column 20 (Yield), has the following parenthetical which should be removed based on discussions with RMA: "*(After trend, substitution, exclusion, as applicable)*". According to RMA, the information entered in this column should be the 'actual yields' harvested by the producer, not the 'adjusted yields' as the parenthetical implies. The deletion of this language, in addition to built-in instructions clarifying

[4] https://ewebapp rma.usda.gov/apps/costestimator/Estimates/DetailedEstimate.aspx

what the user should enter in varying input fields would greatly reduce the level of confusion (albeit minor) that currently exists.

RMA has been making improvements to the Written Agreement process for several years now, with the goal of developing a more electronic process for the agreements through a SharePoint portal between RMA and AIPs. There are some additional considerations included in the list below that RMA should consider to ensure that the application process for a limited irrigation written agreement is as simple as possible, and does not cause undue administrative burden on producers who have already been insured under a fully irrigated policy on the same acreage in the past. The steps required of a producer in order to obtain a limited irrigation written agreement, while not complicated once the process is known, are somewhat piecemeal and require multiple manual steps including the use of several different tools and websites. It is assumed that the process is a joint effort between the producer and his/her agent, but that much of the administrative responsibility falls on the agent. The items required include:

1) A completed request for Actuarial Change form;
   This should be combined with the Documentation Tool for Limited Irrigation in a pre-fillable web-based form that can be printed and signed.
2) A complete APH;
   RMA should already have access to this information assuming the producer has participated in another insurance program previously for the same crop and county. AIPs are required to transmit yield data on P15/15A records through PASS so RMA is able to validate the APH used in establishing producer coverage. However, this could also be included with the completed application packet as well.
3) The legal description of the land and FSA aerial photographs of legible maps delineating field boundaries where the applicant intends to plant the crop for which insurance is requested;
   Producers must transmit ground covered by CLU (common land unit) designation. While not photographic, CLUs do represent geographic boundaries of fields established by FSA and used by producers to report acreage. CLUs are already used under other insurance plans, so should not be an issue to include in this program. However, this could also be included with the completed application packet as well.
4) Local Enhanced Management Area (LEMA) order from the Chief Engineer or delegate;
   This will continue to be provided by the producer as part of the application.
5) A completed "Documentation Tool for Limited Irrigation";
   AgriLogic would propose that this form (Excel/PDF) be combined with the Request for Actuarial Change and the water use records in a pre-fillable web-based form that can be printed and signed; and
6) Hard copy documents verifying water use.
   AgriLogic is unaware if the water use information being pre-populated into the RMA Documentation Tool is considered 'verifiable records'. The information is provided from the Kansas Department of Agriculture via the WIMAS to the Kansas Water Office. If so, integrating this water use history into the pre-fillable web-based form described in items

1 and 5 would satisfy this requirement and remove another step, further simplifying the process.

If RMA could access Items 2 and 3 from its internal databases for the applicant, and Items 1, 5 and 6 could integrated into a single pre-fillable web-based form, then regardless of who completes the necessary documentation, a significant amount of administrative burden could be mitigated. With minimal modification, the Documentation Tool in this way could become not only a decision tool, but also an 'Electronic Written Agreement Application' for potential limited irrigation policies.

LOCAL ADVISORY COMMITTEE EXPERTISE

The importance of utilizing local knowledge and expertise for limited irrigation requires that RMA make extensive use of an advisory committee in any pilot effort. For multiple reasons the Limited Irrigation Crop Insurance Program in Sheridan 6 lacked support from the producers in the area as evidenced by their lack of participation. The creation of an advisory committee will help develop more "local buy-in" for the next pilot effort. The initial advisory committee and RMA would need to agree on the final design of the refined pilot program based on the previously recommended criteria.

Individual irrigation districts were established by the state to apply state water laws and federal programs to fit the groundwater needs and conditions of their local area. Due to the variation in weather patterns, soil types, and regulations between these districts, it is difficult to offer a broad program that accurately addresses a specific region's needs. An active advisory committee for the locality would be an important tool to ensure a Limited Irrigation Crop Insurance Program is appropriately designed to meet the needs of a local area.

The initial advisory committee should include representatives of producer organizations including the Kansas Corn Growers, state water/irrigation scientists with Kansas State University, Kansas Water Office and the RMA (including at least one representative from the Topeka Regional Office). After the pilot area is selected, several local stakeholders should be added to the advisory committee including staff of irrigation districts, producers (potentially irrigation district board members), and local irrigation and agronomic experts. Some of the specific responsibilities of the advisory committee would include:

1) Develop the overall design for the refined pilot program in their area;
2) Establish a process to review and recommend changes to the CWA model (or a similar model if this model is not selected);
3) For the pilot area, the advisory committee should recommend the scope and structure of the training and outreach program for the pilot area. An effective education and outreach program will be essential for the successful implementation of the program.
4) The advisory committee should meet at least annually after the program is launched to continue to monitor, evaluate and potentially make adjustment to the program as

frequently as once a year. Producers and other stakeholders on the advisory committee need to know that they will have an important role in making this program work.

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