

April 2018

## When the Wells Run Dry

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### Recommended Citation

Melgares, Pat (2018) "When the Wells Run Dry," *Seek*: Vol. 8: Iss. 1.

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Melgares: When the Wells Run Dry

# When the Wells

Agriculture in race for solutions  
to the declining Ogallala Aquifer

*By Pat Melgares*



# Run Dry



Tom Willis pays attention to every drop of water that touches his western Kansas farm. That's the reality of farming in this region.

In western Kansas, crops and livestock rely on often sparse amounts of annual rainfall and water pumped from the Ogallala Aquifer, a large underground body of water that scientists say is quickly drying up.

The aquifer covers 175,000 square miles, or about 112 million acres in parts of eight states. For nearly 80 years, farmers and communities have been using the aquifer for agriculture and public water supplies. The Ogallala supports about 30 percent of all U.S. crop and livestock production, accounting for an estimated \$35 billion in agricultural products annually.

So, it's a pretty big deal when scientists say that parts of the aquifer — much of that in western Kansas and south through Texas — may not last more than 20 years.

"I think people conceptually get it that the aquifer is declining, but I don't think they understand that when the aquifer is gone, the feed yards are gone, the farms are gone, the implement dealers are gone, the stores are gone," said Willis, whose farm is about 18 miles south of Garden City.

Science and K-State researchers are on the farmers' side.



## Funding groups prioritize the Ogallala

In 2016, the U.S. Department of Agriculture's National Institute for Food and Agriculture awarded \$10 million to universities in six states to further improve technology and practices that will slow the drain on the Ogallala.

K-State is among nine groups involved in the work, called a Coordinated Agriculture Project, which includes more than 40 university researchers and extension specialists along with their graduate and postdoctoral students.

"The impetus of the project was to provide research and information to producers and policymakers on how to sustain the aquifer or at least extend its life," said Chuck Rice, university distinguished professor of agronomy who coordinates K-State work on the project.



**We want to learn if there is anything we can do to soften the transition from irrigated agriculture or if we can still find ways to sustain the aquifer."**

the aquifer will not be there," said Jonathan Aguilar, a water resource engineer at the K-State Research and Extension Southwest Research-Extension Center in Garden City.

"But at the same time while we're gearing up, we want to learn if there is anything we can do to soften the transition from irrigated agriculture or if we can still find ways to sustain the aquifer," Aguilar said.

That award is in addition to \$1.5 million from the USDA Agricultural Research Service that K-State shares with four universities for the Ogallala Aquifer Program.

"The overriding philosophy of these research efforts is to reduce water use in this region and help producers gear up for the eventuality that



*K-State researchers are working to improve center pivot irrigation, shown here, for crops.*

"The climate projections are that the Ogallala area is going to be drier, and you're going to have more weather extremes in both temperature and rainfall, and that means more intense and frequent droughts," Rice said. "You have two issues: changing climate that is not going to be beneficial to the region because of declining rainfall events, and then the declining aquifer."

## K-State innovations

K-State has focused research on irrigation in some form since the 1950s, but researchers made a big splash in 1989 when they introduced subsurface drip irrigation, a technology in which underground hoses carry water and fertilizer directly to plant roots. The technology conserves water by reducing evaporation, which is a common shortcoming of traditional center pivot sprinklers that spray water above the crop.

Freddie Lamm, an irrigation engineer at the Northwest Research-Extension Center in Colby, Kansas, has led the university's development of subsurface drip irrigation and is an internationally known expert in his field.

"Our goals in 1989 and now are to conserve water, protect water quality and to adapt the technology to

our region and production practices," Lamm said. "In western Kansas, we have conservatively estimated that subsurface drip irrigation can reduce crop irrigation needs by 25 percent."

Researchers recently began more fully testing mobile drip irrigation, a combination of drip irrigation and traditional center pivot irrigation. Mobile drip irrigation relies on hoses attached to a center pivot instead of spray nozzles. As the center pivot rotates in a circle, the hoses snake along the ground and deliver water to the plant roots without wetting the leaves.

"Mobile drip irrigation is catching on," Aguilar said. "The way we see it is if a farmer is on a very limited well capacity, he will see some advantages by using mobile drip irrigation."

Willis has a mobile drip system running on land where one of his wells was on a steady decline.

"On this field, we've been able to reduce the pumping to half and still raise a good crop," Willis said. "It was a 350-gallon-per-minute well, and we're running it at 200. Our challenge is not how do we raise bigger crops, but it is how do we reduce water and keep our income at least static. On part of the farm, it meant going to a livestock

program. We're experimenting with the mobile drip to see just how low we can go."

K-State researchers have developed other technologies to ensure efficient water usage. Danny Rogers, a longtime biological and agricultural engineer, was one of the university's pioneers in using soil moisture sensors to determine crop water use in a farm field. Sensors are installed below ground at strategic locations in the farmer's field.

Rogers was also instrumental in promoting climate-based irrigation scheduling. He developed software that helps farmers decide when and how much irrigation water to apply based on crop water use or evapotranspiration, determined by current weather data.

Today's versions of those technologies send real-time information to farmers' cellphones, allowing them to make water management decisions based on data rather than just a hunch.

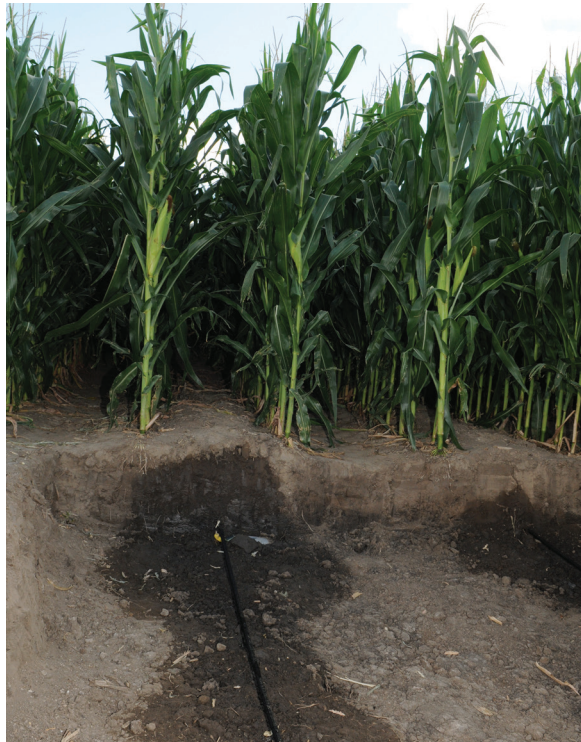
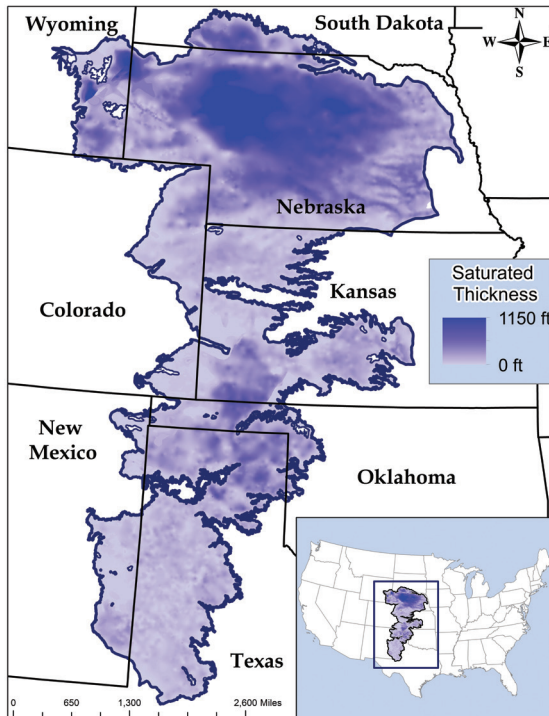
"There are a lot of promising technologies, but the technology has to be implemented, and you still have to implement a management decision based on the information that technology gives you," Rogers said.



*The Ogallala Aquifer, also called the High Plains Aquifer, touches parts of eight states. Geologists say that the aquifer is thicker in the northern sections but dwindling quickly in southern sections.*

*Subsurface drip irrigation was developed by K-State researchers in the 1980s. Underground hoses carry water and fertilizer directly to the plant's roots, thereby conserving water by reducing evaporation.*

*Tom Willis, who farms about 18 miles south of Garden City, checks hoses on his mobile drip irrigation system. The Willis farm is one of five water technology farms in Kansas and was established to help farmers see how new technology works.*



## Targeting dryland agriculture

In addition to incorporating new technology, farmers in western Kansas are looking at new ways to farm the old-fashioned way. Dryland agriculture relies on natural rainfall and is common in regions like Kansas where a cool, wet season is followed by a warm, dry season.

Much of western Kansas received less than 20 inches of precipitation last year. John Holman, an agronomist at the Southwest Research-Extension Center, is studying the best ways to make use of rain. Holman said fewer wells are pumped each year. In addition to the water table varying across the aquifer, some areas are experiencing high salt content, which means the water quality is becoming poor.

“My main focus is once we are at that point of depletion as we are farming mostly dryland, what do we do to sustain the farm?” Holman said. “Not only does it have implications for the producers, but it has implications on the whole regional economy. You’re no longer buying as much fertilizer or chemical from those suppliers, you’re not hauling as much grain into the elevator ... you have that whole ripple effect.”

In addition to overseeing on-farm trials and working directly with local farmers, Holman is conducting studies at the research station, testing the effectiveness of such things as tillage practices and crop rotations. He is exploring the benefits of planting corn, sorghum, canola, wheat and more.

“If producers knew what the weather was going to be like in the coming growing season, they could manage their inputs and crops better,” he said. “The unknown is a real challenge without irrigation.”

## Community cooperation

Willis and other farmers agree that it’s going to take more than just a few of them to adopt technology or water-saving practices to make a positive difference on the Ogallala Aquifer.

“One of the problems is that some farmers believe that if they reduce water use and their neighbors don’t, the neighbors are just going to use the water that’s under his land,” said Bill Golden, an agricultural economist with K-State Research and Extension. “That way of thinking makes matters worse and lessens the chance that everyone works cooperatively to solve the water decline problems.”

In 2013, Kansas farmers set up a 10-square-mile conservation zone in western Sheridan and eastern Thomas counties, called the Sheridan 6 Local Enhanced Management Area. Farmers in this area agreed to reduce irrigation by 20 percent for five years to see if they could maintain profitability while helping to extend the aquifer’s life.

Golden recently released a report of the first four years of that project, and it’s very promising. Compared with their neighbors outside the management area’s boundary, irrigated crop producers reduced total groundwater use by 25.7 percent and did not experience any loss of profits.





“We say there is no profit loss, but actually, the people who have reported their corn yields are making a little more money and have reduced water,” Golden said. “I hesitate to jump up and down and say you’re definitely going to make more money when you reduce water use, because that’s a little unbelievable. We just say there is not going to be any profit loss.”

## Water as a social issue

K-State sociologist Matthew Sanderson is working with the Coordinated Agriculture Project grant from the National Institute for Food and Agriculture to understand the cultural norms, values, traditions and other variables that farmers consider when voluntarily choosing to reduce water use.

“This is not an area that has been looked at by researchers, especially in agriculture, but we think it is a promising direction when we are trying to find answers to a problem that has been around a long time,” Sanderson said.

So far, Sanderson’s graduate student Stephen Lauer has interviewed Kansas farmers in person, and over the winter, Sanderson and Lauer sent surveys to farmers in more than 200 counties in Nebraska, Colorado, Kansas, Oklahoma, Texas and New Mexico. Concrete results will take time, but Sanderson is already seeing some trends.

“In the first 20-30 minutes of our face-to-face interviews, we hear a lot about economics and prices and the need to keep their operation financially viable,” Sanderson said. “But as these conversations go on, we start to hear more about people’s fears and hopes, we start to hear about why they farm — we start to hear about what’s important to them.

“They’re making a living, clearly, and I don’t want to diminish that. But making a living is something else than just earning the money for a lot of these folks. It has to do with longevity of the farm and about passing it on. Their farm is not just a retirement plan — it is a way of life. Water clearly has a monetary value, but it also has a cultural value, and it has a set of principles and ideas in it that people want to pass on.”

*Top: Soil moisture sensors installed below fields give farmers important information on the amount of moisture available to their crops. Bottom: Center pivot sprinklers have served Kansas well over the years, but new technologies aim to make irrigated agriculture more efficient.*



## Water tech farms help boost technology

Dan Devlin is the director of the Kansas Center for Agricultural Resources and the Environment at K-State and manages funding and priorities for the center’s Kansas Water Resources Institute.

“If somebody at K-State wants to know about water, they come to our center,” Devlin said. “I work with stakeholders and agencies to determine the research needs and extension needs for our state.”

One of the priorities that Devlin helped move along with the Kansas Water Office, a state agency, was the idea of water technology farms. Willis’ farm is one of five in Kansas funded by private and public groups to test the newest technology for saving water. The farms host several field days so that farmers can see firsthand how well these technologies work.

“We want to find tools to make change, to save water,” Devlin said. “We often think about the individual farmer and the irrigator, but we’re really thinking about 40 years in the future and the next generation or two.”

Willis says he hopes the water technology farms will help to stop the aquifer’s decline.

“We’ve done the damage, so now we need to find out if there is a way to hold it static so that instead of lasting 20 years, it will last 60 or 70 years,” Willis said. “Maybe the next variety of super corn or milo that comes out will be one where you can raise 200 bushels on 10 inches of moisture.”

He adds: “This is a stop-gap to get you to the next generation of technology. This in and of itself is not going to save the aquifer. What I’m trying to do is take pressure off it, make it more sustainable, with the hope that there are new technologies that continue to come that allow us to do more with less.” **K**