2024

OKLAHOMA

2021 OGALLALA (VIRTUAL) SUMMIT-INSPIRED ACTIVITIES

Since the 2021 Summit, we have noted an elevated awareness and support for efforts to improve irrigation efficiency in Oklahoma. Each year at the Oklahoma Governor's Water Conference and Research Symposium, the Oklahoma Water Resources Center (OWRC) and Oklahoma Water Resources Board (OWRB) have organized plenary panel discussions on improving ag water use efficiency. This has expanded the awareness of and discussions on challenges and solutions to irrigation water conservation in the State.

Oklahoma State University (OSU) Extension and the Oklahoma Water Resources Center launched the yearly/annual Oklahoma Master Irrigator (MI) Program in 2021 with the support and assistance of the Oklahoma Conservation Commission (OCC), OWRB, Oklahoma Panhandle Ag Irrigators Association, Oklahoma Department of Ag, Food, and Forestry (ODAFF), and U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS). This program is designed to educate and familiarize producers with the latest water conservation and irrigation scheduling technologies

Authors: Kevin Wagner (OSU), Jessica Fritsche (Carollo), Zachary Tomlinson (OWRB), Sumon Datta (OSU), Derrick Wagner (OWRB), Sumit Sharma (OSU)

and strategies, as well as infrastructure maintenance to improve water use efficiency. The program facilitates the adoption of these technologies by producers using a combination of advanced training, incentives, and on-farm evaluation. However, the core component of the MI Program is the four-day classroom training that covers basic as well as advanced curriculum on irrigation. The speakers for the program include experts from academia, industry, NRCS and crop consultants. Four sessions of the program have been delivered at different locations across the state. Program curriculum is tailored for each region and based on input and feedback from local producer advisory committees.

Since its launch in 2021, a total of 89 people have graduated from 4 program sessions, which represented producers, crop consultants, NRCS personnel, local county extension educators, and industry. The producers and crop consultants together represented approximately 160,000 irrigated and dryland acres in first three sessions of the program. In the post program surveys nearly 37% of the participants responded "a great deal" in knowledge increase regarding irrigation and 58% responded with moderate level change. Over 35% of the ag irrigators who have graduated from the first three sessions of MI program to date have purchased moisture sensors. The mobile irrigation lab at OSU continues to provide audits for pump energy efficiency and irrigation water uniformity for graduates. The statistics for the fourth session are currently under evaluation. The OCC provides graduates with up to $2000 to purchase soil moisture sensors, irrigation schedulers, or other conservation technology. Finally, NRCS continues to provide added points for MI graduates' EQIP applications.

With funding from the state legislature and Oklahoma Conservation Commission, OSU also launched a study in 2021 of the benefits of advanced irrigation management in the Ogallala Aquifer in Oklahoma. OSU is evaluating current irrigation systems and technologies used in the Oklahoma Panhandle and utilizing this data to develop preliminary estimates of irrigation water usage and potential water savings from adoption of advanced irrigation technologies and management (e.g., drip irrigation, LESA or LEPA systems, sensor technologies, irrigation schedulers, VRI, various pumping systems). These evaluations and studies will help our understanding of the potential benefits of these practices on the aquifer and its long-term viability and help set the stage for further studies and assist with water planning for the region.

In the fall of 2023, Dr. Sumit Sharma was invited to speak to an Oklahoma legislative committee about MI. Broad support from legislators, agencies, and irrigators in Oklahoma for the Master Irrigator program continues. In December 2023, the MI program won the prestigious Oklahoma Water for 2060 award.

Recently, an agreement between the U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS) and the "Climate-Smart Advances in Ag Performance" multistate team was initiated in the fall of 2023 to strengthen and expand access to the Testing Ag Performance Solutions (TAPS) and MI programs, engage producers and agricultural sector partners in the High Plains and Colorado River Basin, and share project insights regionally and nationwide with interested agricultural audiences. Specifically, this project will work to:

- Support producers in effectively using precision and advanced management tools and strategies for conservation and productivity in irrigation-dependent agricultural regions
- Benchmark greenhouse gas (GHG) emissions associated with irrigated agriculture
- Link irrigated cropping and livestock production system and related value chains as a common community of practice
- Strengthen and expand TAPS and Master Irrigator programs, track conservation impacts, test climate-smart incentives, and inform evidence-based policy and governance

OTHER KEY ACTIVITIES UNDERWAY, POLICY SHIFTS, NEW/CORE INITIATIVES

Work on the **2025 Oklahoma Comprehensive Water Plan (OCWP)** is underway. Technical work for the OCWP 2025 update included re-estimating current water use and projecting trends to 2075. On an average weather year, it's estimated that crop irrigation in the Oklahoma Panhandle uses 522,000 acre-feet (AF) of water. With other users, total annual withdrawals are an estimated 540,000 AF, making the Ogallala Panhandle aquifer the most heavily used aquifer in Oklahoma by over 5 times.

Provisional data from the OCWP projects continued growth of irrigated acres and crop irrigation water withdrawals well into the future with total annual water demand increasing 6.7% between 2022-2075 from 541,369 AF to 577,737 AF. Most of this growth in irrigated acres and water use is expected to occur within Cimarron and Beaver Counties with little to no change occurring in Texas County.

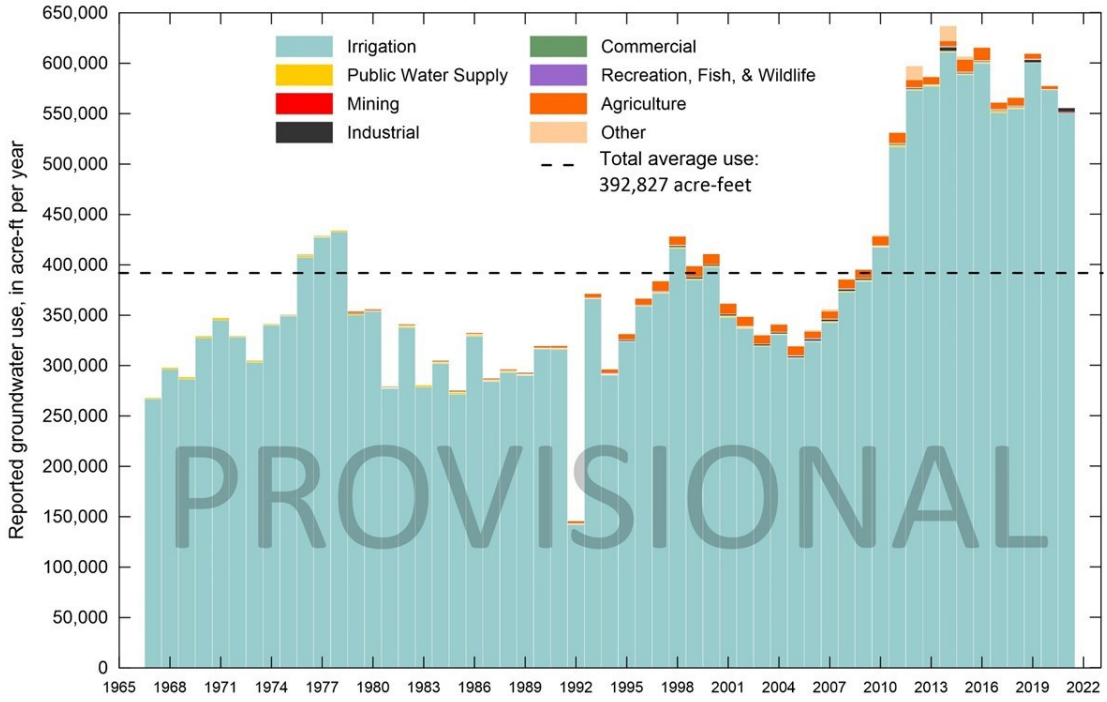

Figure 1. Reported water use to the OWRB for permits overlying the Ogallala – Panhandle groundwater basin, sorted by type. Note that 1992 is very low because a number of water use reports from that year were never entered into the database due to disruption from the Murrah bombing in 1995.

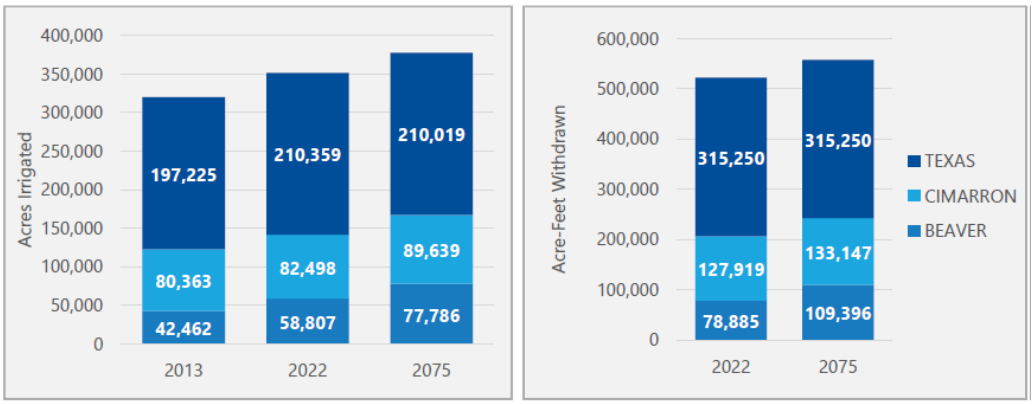

Figure 2. Current and future projected irrigated acres and irrigation water use.

Provisional data from the OWRB also shows groundwater declines of ≥20 feet over the 40 year period between 1982-2022. However, OWRB comparison of water level data from 1982-2002 to data from 2002-2022 indicates that the majority of that

decline (≥70%) has occurred in the last 20 years. Further, OWRB analysis shows that water-level decline is significantly greater under permitted areas with average declines of almost 25 feet in permitted areas versus 12.5 feet in areas with no wells permitted.

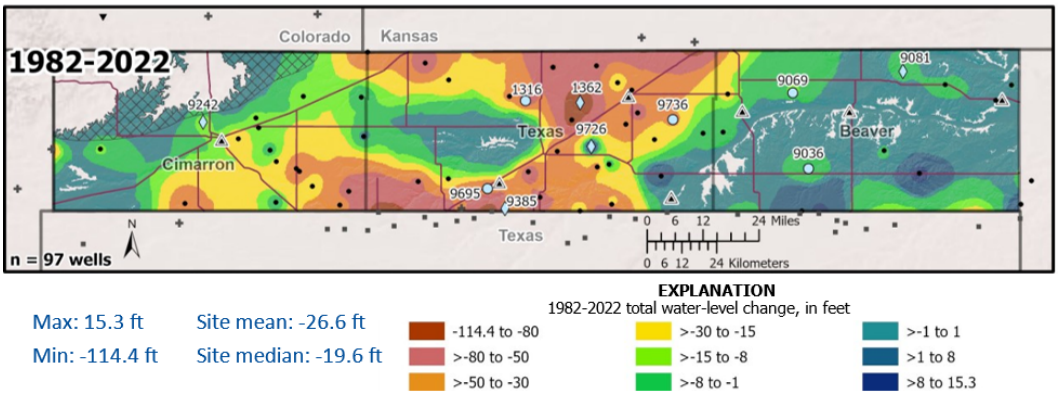

Figure 3. 1982-2022 water level changes in the Oklahoma Panhandle portion of the Ogallala Aquifer.

The OWRB is also working with the USGS on a new hydrologic study of the Ogallala Panhandle and Northwest aquifers that will be the basis of a new groundwater-flow model to assist in updating the maximum annual yield of the aquifers. The objectives of the study are to update knowledge of the hydrology and the hydrogeology for the Ogallala aquifer from 1998 through 2022. The study will investigate surface water and groundwater flows and provide a conceptual-flow model describing surface and groundwater interactions. Additionally, this study will provide an updated delineation of the extent of the freshwater in the Ogallala aquifer. The results of this study will be used to develop a future groundwater flow model for simulating various climate and water-use scenarios that will inform the OWRB in managing water resources in the Ogallala aquifer. The study will provide insight into the hydrogeologic framework of the Ogallala bedrock aquifer that will assist OWRB in managing water resources. State and county municipal water managers and citizens will benefit from an improved understanding of the relationship between groundwater and surface-water in the Ogallala bedrock aquifer.

Finally, the OWRB and their contractor, Carollo Engineers, have formed an Irrigators workgroup, bringing together irrigators, cattle producers, landowners, well drillers, and others to assist in identifying solutions for the aquifer. This group has explored the main challenges and potential solutions and set a goal to Extend and protect the generational longevity of the Panhandle. Upcoming focus basin work will identify mitigation strategies to improve the management of the Ogallala.

Oklahoma-Hydronet to Improve Groundwater Data Availability

Scientists and engineers from Oklahoma State University, the University of Oklahoma, the Oklahoma Water Resources Board, and the USDA Agricultural Research Service are developing the Oklahoma Hydronet as an integrated, statewide monitoring system for surface water, soil water, and groundwater. By utilizing and augmenting existing monitoring sites, **the Hydronet will provide new real-time data-streams on soil water, groundwater, and surface water reservoir levels across the state.** Most prior groundwater level data in Oklahoma are from discrete annual measurements, with only a small subset of wells equipped with water level sensors and dataloggers that collect hourly depth-to-water measurements. The Oklahoma Hydronet project will greatly expand the number of wells in the state instrumented with continuous water level sensors and make the data available to the public in near real-time. Through this project, the OWRB will select up to 60 existing groundwater wells in aquifers throughout Oklahoma to install water level transducers, data cables, and telemetry instrumentation.

Oklahoma Mesonet Irrigation Planner

Efforts are underway to develop an advanced irrigation planner using Oklahoma Mesonet's resources. The current irrigation planner, while it works well, is a simple water balance that has several limitations. The current irrigation planner does not account for soil textural information which is a key input needed to estimate crop water use, crop evapotranspiration (ETC). As a result, it cannot account for crop specific irrigation thresholds such as management allowed deficit (MAD), rooting depth, and plant height. Furthermore, the planner does not correct for changing relative humidity and wind speed that can significantly impact ETC estimations. To address these limitations, researchers from Oklahoma State University are closely working with Oklahoma Mesonet to develop a more accurate, advanced irrigation planner based on dual-crop coefficient for ETC estimation. The new planner will be able to take more in-season user inputs from producers on soil textural data and irrigation/precipitation amounts and provide recommendations on when to start irrigation along with detailed information on different water fluxes such as ETC, deep percolation, runoff, and soil water storage. If user inputs on soil data are not available, then the new planner will import data from Oklahoma Mesonet or Soil Survey Geographic Database (SSURGO) from United State Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The versatility of this new irrigation

planner is in the user's ability to provide in-season user inputs along with implementation of an advanced, accurate estimation method of crop water use making timely irrigation decisions more precise than its predecessor.

KEY CHALLENGES

As part of the 2025 OCWP efforts, 51 Panhandle ag producers, including a mix of small, medium, and large irrigators and ranchers, were surveyed by Carollo Engineers in November 2023 regarding challenges and potential solutions. The top 5 challenges identified by respondents were **1) depletion, 2) conflicts, 3) water quality, 4) attitudes and behaviors of producers, and 5) the possibility of more regulations.** Potential solutions included 1) crop choice, and utilization of 2) soil health practices, 3) soil moisture sensors, 4) metering, and 5) irrigation scheduling.

Other findings from the survey were that:

- Only 60% of respondents believe groundwater decline is a serious problem.
- 55% disagree that there is ample water to sustain agricultural production for the next 20 years.
- 67% disagree that there is ample water to sustain agricultural production for the next 50 years.
- 80% of respondents agreed groundwater should be conserved.

Consistent with the "attitudes and behaviors of producers" identified above, adoption of irrigation scheduling technologies has been low in Oklahoma. The 2018 Irrigation Water Management Survey from the USDA National Agricultural Statistics Service reported that only 6% of Oklahoma farmers use any kind of irrigation scheduling approaches. In many cases, there is not a good understanding of actual water use or aquifer conditions. Further, many producers are resistant to many of the solutions identified in the 2023 survey discussed above including metering, adopting lower water use crops, and reduced pumping (i.e., pumping limits). The reasons behind low adoption are often multi-faceted since social, economic, and technical drivers are responsible for technology transfer and adoption. Further, the diversity of operations in the region prevents a one-size-fits-all approach. Successful approaches must take a toolbox approach to provide producers as many tools and opportunities as possible to ensure the sustainability of their operations and the aquifer.

PARTNERSHIPS, INTERSTATE INTERACTIONS, AND COLLABORATIVE EFFORTS

Good partnerships exist between the OCC, OWRB, ODAFF, NRCS, and OSU. Further, the land grant universities and Water Resource Research Institutes across the Ogallala have strong, long-standing relationships. However, greater collaboration is needed among all the water users across the aquifer to ensure the long-term economic viability of the communities and industries that rely on the aquifer. The animal industry is a major economic driver throughout the aquifer and needs to be at the table. Potential synergies between industry sustainability programs and water conservation need to be explored. Financial institutions (i.e., farm credit, crop insurance, etc.) also need to be at the table to ensure they have a voice since decisions made have a long-term impact on the economics of the region. Finally, greater assistance is needed to support water conservation efforts including greater financial and technical assistance for producers, expanded education and outreach programs, improved aquifer monitoring and data availability, and economic analysis regarding alternatives. Together, we can find solutions, but it will require a concerted effort to get there.

REFERENCES AND IMPORTANT LINKS

Oklahoma Water Planning (https://oklahoma.gov/owrb/water-planning.html)

Oklahoma Master Irrigator Program (https://extension.okstate.edu/programs/master-irrigator/)

OSU Extension Irrigation Resources (https://extension.okstate.edu/topics/environment-and-natural-resources/water/irrigation/)

Oklahoma Water Resources Center (https://water.okstate.edu/)

Oklahoma Water Resources Board (https://oklahoma.gov/owrb.html)

Oklahoma Conservation Commission (https://conservation.ok.gov/)

Oklahoma Department of Agriculture, Food, and Forestry (https://ag.ok.gov/)

USDA-Natural Resources Conservation Service (https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/oklahoma)

Carollo Engineers (https://carollo.com/)