



# 2020 Annual Report

## Oklahoma Water Resources Center

We are Oklahoma. We are water.

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Our Reach

## *Our Mission*

Empowering informed decision making & enriching understanding of the state's most critical water management issues through engagement, education and actionable science

## *Our Vision*

Safe, secure, and sustainable water resources for all.

## *Our Purpose*

Located at Oklahoma State University, the Oklahoma Water Resources Center (OWRC) has been providing science-based, community-supported solutions for the state's pressing water quantity and quality challenges for over 55 years. Established in 1965 by the Water Resources Research Act, the OWRC is one of 54 institutes/centers within the National Institutes for Water Resources, supported by the United States Geological Survey. This act charged the institutes with:

1. Planning, facilitating, and conducting **research** to aid in the resolution of State and regional water issues
2. Promoting **technology transfer**, dissemination of research findings, and implementation of improved technology and management practices
3. **Training** the next generation of water scientists and engineers through experiential-based learning and continuing education
4. **Collaborating** with other universities and partners in the State to develop a statewide program to meet the needs of the state
5. **Administering grants** funded via the USGS 104 program and other sources

# Investing in Our State



The Center engages 25 state, federal, tribal and private organizations through its Water Research Advisory Board to set research priorities and select projects for funding.

With funding from the USGS 104b program, in 2021 the OWRC funded five projects:

1. **Zooplankton-Harmful Algal Bloom feedback loops in Oklahoma Reservoirs**
2. **Microplastic pollution of Oklahoma freshwater systems and the potential interactions with contaminants of environmental and health concern**
3. **Bioelectric Treatment of Nitrate Impaired Waters**
4. **Testing the relationship between isopod distributions and groundwater connectivity in the Prairie Plains of Northeastern Oklahoma**
5. **Utilizing high resolution space-air-ground platforms for early detection of cyanobacteria at near-shore locations in reservoirs**
6. **Synthesizing a novel fouling-resistant polyacrylic acid membrane utilizing UV-grafted technique on  $\alpha$ -alumina for treating produced water.**

We connect research teams and communities to multidisciplinary expertise by serving as a gateway to a national network of water institutes, Oklahoma State University faculty, and other universities and water resources organizations.



# Addressing and Meeting Oklahoma's Water Needs

## Oklahoma Master Irrigator Program

The use of irrigation scheduling tools to manage irrigation water application can increase water productivity, but with less capital cost than installing new irrigation systems.

### Findings from prior research using precision irrigation scheduling in the High Plains region:

- Increased water productivity by 25% compared to conventional irrigation application.
- Achieved with a 10% reduction in water use and a 13% yield increase.
- This suggests that adoption of precision irrigation management could reduce water demand by 76,000 acre-feet/year statewide without impacting, and potentially increasing, productivity.

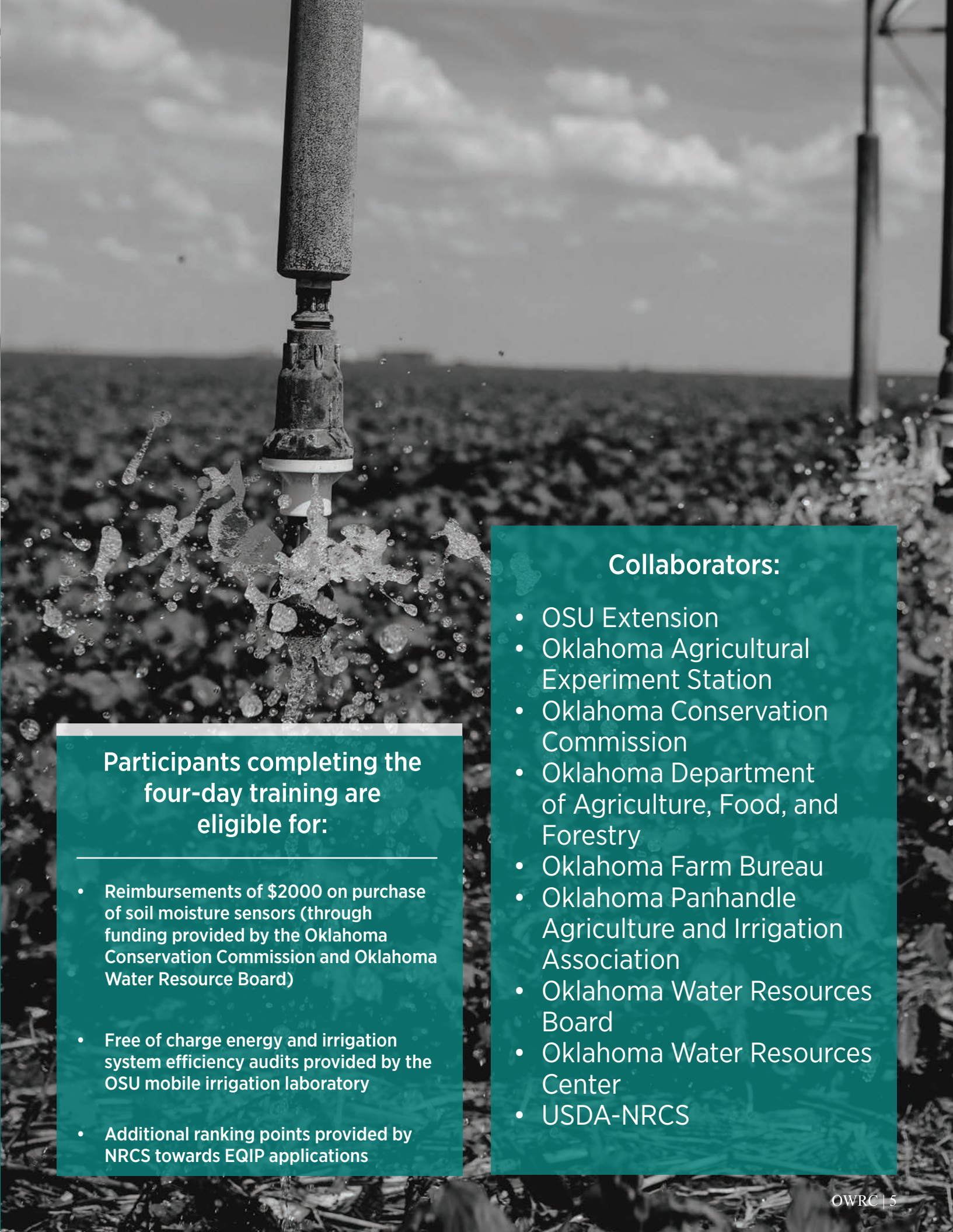
However, the use of irrigation scheduling technologies and tools, such as soil

moisture sensors and/or crop growth model based irrigation schedulers, require advanced knowledge to apply effectively.

To address this, Oklahoma State University has initiated a Master Irrigator Program to provide advanced training on irrigation water management, irrigation equipment maintenance, energy conservation, water conservation, and economics of irrigated agriculture. The program includes classroom training, peer-to-peer exchange of information between producers, and field demonstrations.

### Goal of the Program

The program's overall goal is to facilitate improved water use efficiency and farm income via increased farmer adoption of advanced water management strategies and technologies.



### Participants completing the four-day training are eligible for:

- Reimbursements of \$2000 on purchase of soil moisture sensors (through funding provided by the Oklahoma Conservation Commission and Oklahoma Water Resource Board)
- Free of charge energy and irrigation system efficiency audits provided by the OSU mobile irrigation laboratory
- Additional ranking points provided by NRCS towards EQIP applications

### Collaborators:

- OSU Extension
- Oklahoma Agricultural Experiment Station
- Oklahoma Conservation Commission
- Oklahoma Department of Agriculture, Food, and Forestry
- Oklahoma Farm Bureau
- Oklahoma Panhandle Agriculture and Irrigation Association
- Oklahoma Water Resources Board
- Oklahoma Water Resources Center
- USDA-NRCS



## Treatment and Reuse of Waste Water

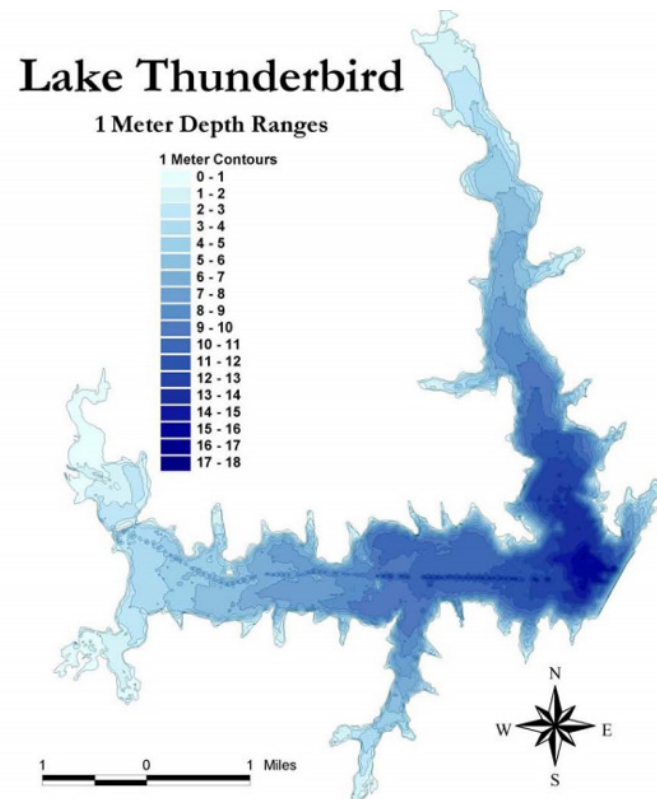
**Oklahoma's water demands are projected to increase 600,000 acre-feet per year between 2007-2060.**

Reliable water supplies are needed to meet these demands and the State's Water for 2060 goal. Reuse of produced water and municipal wastewater has the potential to provide substantial quantities of water for the industrial, energy, agricultural, and municipal sectors, making communities and economies more resilient to increasing climate variability.

Scientists and engineers from Oklahoma State University, the University of Oklahoma, and Southwestern Oklahoma State University are working closely to make reuse technologies and systems more effective, acceptable, sustainable, and efficient. Supported by funding from the NSF EPSCoR program, this team is working to:

1. Improve passive treatment of contaminants in wastewater effluent & stormwater runoff using biofiltration, treatment wetlands, and natural waterways
2. Improve removal of nitrogen and contaminants of emerging concern from stormwater and wastewater using new biological and chemical processes
3. Enhance removal of hydrocarbons from produced water via bioremediation and development of new anti-fouling membranes

4. Increase use of produced water for enhanced oil recovery through the development of innovative high salinity carbonated (CO<sub>2</sub>) produced water flooding technology
5. Develop new approaches and model(s) for optimizing water augmentation strategies considering public needs/perceptions and system efficiency, sustainability, and resilience



## Grazingland Water Quality

**In Oklahoma, 676 water bodies (rivers, streams, and lakes) do not meet water quality standards and are designated as impaired. Grazing and wildlife have been identified as significant causes of these impairments.**

The Oklahoma Water Resources Center is working with the Natural Resources Ecology and Management, Animal Science and Biosystems, and Agricultural Engineering Departments to better understand how land use and land management impact water resources and identify new solutions for addressing possible impacts. With support from the Thomas E. Berry Professorship, OSU is working to:

- Quantify nutrient, E. coli & sediment runoff concentrations & loadings from a variety of land uses & land covers
- Determine the relationship between sediment concentrations and loadings of E. coli in surface runoff under different vegetation types
- Assess differences in wildlife relative abundance in a variety of land uses & land covers and related impacts on E. coli concentrations

In addition to this, OSU had partnered with a

U.S. based virtual fencing company to evaluate the use of new virtual fencing technology, which employs GPS-enabled collars on individual cattle to provide auditory & electric stimulus, to improve the management of livestock grazing. Preliminary data found that virtual fencing is 60% effective on average. The team will be expanding their efforts this summer, with funding provided by EPA, to evaluate the ecosystem improvements provided by the implementation of this technology.





# Engaging and Educating the Public

## Spotty Rain Campaign

Drought is a slow-onset disaster with widespread ecological and economic impacts. More accurate rainfall information can help scientists determine where and when devastating droughts may occur. In partnership with the National Drought Mitigation Center (NDMC) and the Community Collaborative for Rain, Hail, and Snow Network (CoCoRaHS), the Spotty Rain Campaign works with rural libraries to encourage volunteer drought monitoring and to share resources for managing drought risks. Our program focuses on professional development for librarians, educational media for library patrons, and co-sponsoring library programs. To date, we have:

- Hosted 10 webinars on drought, climate change, and citizen science for library audiences
- Piloted a professional development workshop and mini-grant with rain gauges
- Exhibited at 3 national and state library

- conferences with 2,000+ librarians
- Designed promotional and educational media using augmented and virtual reality, including the Make-It-Rain app
- Designed a Virtual Citizen Science Expo & Outdoor Explorer program in collaboration with the Southeast Oklahoma Library System

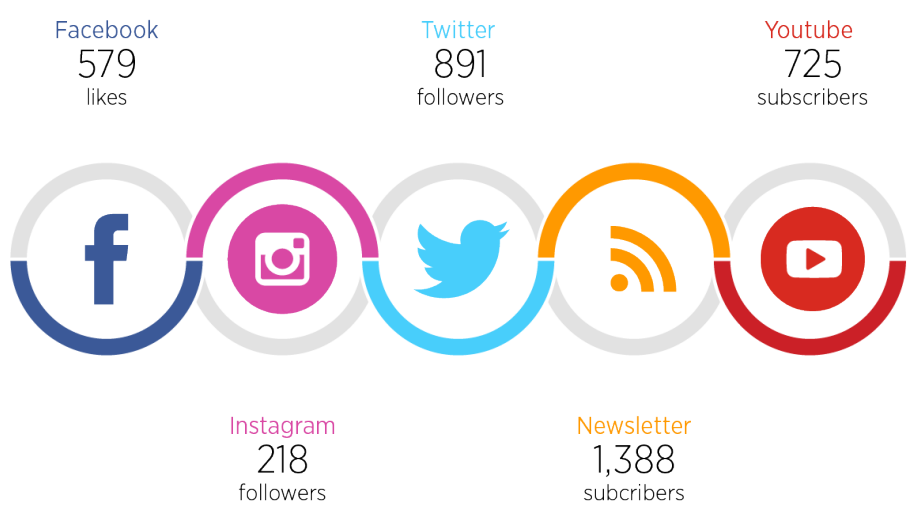


## Our Reach



The Water Center participated in the submission of 27 proposals in 2020 (requesting \$33,451,818). Five projects (see below) were awarded in 2020 providing over \$20M in new funding for research, education and extension.

- Socially Sustainable Solutions for Water, Carbon, and Infrastructure Resilience in Oklahoma (S3OK)
- Oklahoma Water Resources Research Institute Program (USGS Base Funds FY20)
- Oklahoma Master Irrigator Mobile Irrigation Lab & On-Farm Demo Program
- Sustaining Agriculture through Adaptive Management Resilient to a Declining Ogallala
- Development of OK-HAWQS



### Connect with Us

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