

# THE AQUAHOMAN

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The newsletter of the

**OKLAHOMA  
WATER RESOURCES CENTER**

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It's our **50<sup>th</sup>**



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## From the Director's Desk (by Garey Fox)

The 36<sup>th</sup> Oklahoma Governor's Water Conference and Research Symposium was a tremendous success!

The Oklahoma Water Resources Center plans and organizes the Water Research Symposium in partnership with the Oklahoma Water Resources Board. This year we held our first joint session: Education and Outreach Campaigns for Water Conservation and Reuse. It was great to hear about urban water conservation, from two perspectives: Oklahoma City Utilities, represented by Bret Weingart, and Oklahoma Cooperative Extension Service, via Justin Moss.

Our invited speaker, Dr. James Butler, Jr., of the Kansas Geological Survey, discussed ways Kansas monitors groundwater resources under their prior appropriation system. The practices he presented help Kansas understand water levels in their aquifer systems and inform sustainable extraction rates. As a recommendation from the Oklahoma Comprehensive Water Plan, the state of Oklahoma is moving in that direction for understanding

our groundwater, as part of its creation of the Groundwater Monitoring and Assessment Program. This program is comprised of approximately 750 monitoring wells in Oklahoma's 21 major aquifers. Such monitoring will be vital as we work towards meeting Oklahoma's *Water for 2060 Act* goals.

After receiving such good feedback from last year's Café-Style poster session, we decided to repeat it. In what other setting can you hear about 27 research projects in under an hour? In addition, students were matched with professionals to network over lunch. Both students and professionals told us how much they enjoyed it! For more student opportunities, visit [the Student Section](#).

Presentations and posters from this year's Symposium are being added daily at <http://water.okstate.edu/activities/symposium/2015>.

Another primary theme at this year's conference and research symposium was innovations at the nexus of food-energy-water: Water is required to grow food and create energy, energy is



**Dr. Garey Fox welcomes everyone to the Water Research Symposium**

required to treat and distribute water and produce food, and crops can be grown as a source of energy. The nexus is a key focus area for several federal funding agencies including the National Science Foundation (NSF). Oklahoma researchers should begin preparing future proposals explicitly on this theme, as more than \$75 million in funding is anticipated from NSF alone on this priority area. Having recently participated in a special NSF workshop on defining funding priorities I can guarantee you that Oklahoma is uniquely positioned for addressing key research questions on this nexus of food-energy-water.

## Using Cosmic Rays to Measure Soil Moisture

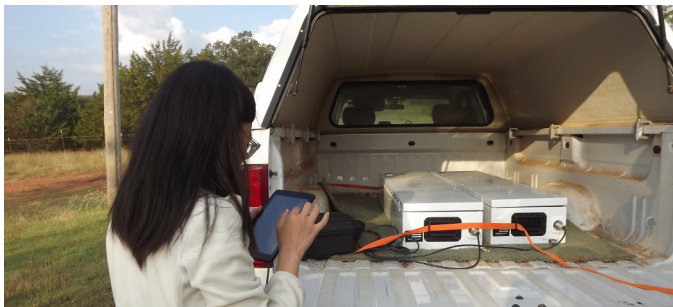
(by Joshua Cross, DWRC staff writer)

Researchers at Oklahoma State University, led by Dr. Tyson Ochsner, are working with cutting edge technology that provides high-quality soil moisture data that may prove useful to help predict floods and wildfires.

The Rover uses cosmic rays as “a way of inferring soil moisture over a large area by counting neutrons above the ground.”

“It’s a revolutionary kind of technology that has not existed until just a few years ago,” says Ochsner, who has labelled this new instrument a Cosmic Ray Neutron Rover.

To explain how this technology works, Ochsner said high energy cosmic rays are constantly coming in at the top of our atmosphere. “These are mostly high speed protons,” he said, “and they collide with atoms and molecules in our atmosphere and eject neutrons, which travel at a very high rate of speed. Those continue down through the atmosphere kind of like a cascade effect, and then start to interact with more molecules near the land surface.”



**Ph.D. student, Geano Dong, collecting a soil sample near Marena, Oklahoma, for use in calibration of the cosmic-ray neutron rover.**

Most notably, these fast neutrons begin to interact with hydrogen molecules. “Hydrogen has an atomic mass unit of one,” Ochsner says, “and the neutron has an atomic mass unit of one. When they hit each other the neutron loses a lot of its speed because it’s the same weight, so hydrogen is really effective at slowing those neutrons down. It’s kind of like if you roll a pool ball into another one of the same size, then they’ll both move away at a lower rate of speed.”

The more hydrogen near the earth’s surface, the fewer fast neutrons to be counted. Ochsner says this hydrogen is mainly in the form of water, and most of that from soil moisture. While water comes in various sources, Ochsner explains, “the one that changes the most dynamically in time is the soil moisture. We can make a relationship between the intensity of fast neutrons above the surface and the amount of soil moisture below the surface. So if we have a lot of soil moisture, we’re going to observe very few

fast neutrons, and as the soil starts to dry out we’ll observe a greater number of fast neutrons.”

Because these neutrons travel at such high speeds, the COSMOS instruments are able to measure the soil moisture in a large area. “The reach of this instrument might be 200 or more meters in diameter,” Ochsner says. “That’s really important because soils and soil moisture are incredibly variable. If we had a sensor that measured only a handful of soil, then we’ve got to take a lot of readings to find out the average for a field. This new technology really helps by integrating up to field scale measurement.”

Funded by National Science Foundation’s Experimental Program for Stimulating Competitive Research (NFS EPSCoR) program, the Rover currently being tested at OSU is “a larger version of the COSMOS instrument that can detect more neutrons in a short amount of time,” according to Ochsner. Because the Rover is portable, “we can put this large neutron counter in a vehicle, drive down the gravel roads, and sense the soil moisture in fields around us, so we can start to make detailed soil moisture maps.”

According to Ochsner, there are “probably only five or six of these rovers in use today. There aren’t many of these built with this purpose in mind.”

Ochsner says the goal of this research is to learn what major factors control soil moisture variability from one location to another. “We can feed this detailed soil moisture information into a decision support or modeling framework. Within this framework, we can make more accurate predictions about potential floods and wildfires.”

This research could also potentially benefit ranchers who “can adapt their stocking rate so they don’t overgraze,” Ochsner says. “That’s an application that we hope to develop.”

Currently, the OSU research team is focused on documenting the calibration and validation procedures for the Rover that will help establish precise instructions for its use, which they could then teach to other researchers across the state to expand these detailed soil moisture maps.

“The Rover will be infrastructure to be shared among other researchers in Oklahoma,” Ochsner says. “By the end of the project we hope this is a resource that is developed for other people to use.”

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Excerpted from full article at <http://water.okstate.edu/strengths/weather/plant-available-water>.

## BRACE FOR IMPACTS: Building Plans for Deteriorating Infrastructure

(by Joshua Cross, OWRC staff writer)

Since its creation in 1965, the Oklahoma Water Resources Center has fostered collaboration and supported Oklahoma's researchers through seed money in the form of U.S. Geological Survey (USGS) 104(b) grants. During the past 50 years we have funded scores of research projects that help us understand Oklahoma's water needs and solve problems. One of the largest problems facing Oklahomans in the immediate future is outdated water infrastructure. The costs to improve or replace existing infrastructure can be enormous, if not crippling, especially in small communities throughout the state.

The American Society for Civil Engineers' (ASCE) 2013 Report Card awarded Oklahoma [a grade of C-](#) on overall infrastructure. More troubling, the **ASCE graded Oklahoma's water infrastructure a D+**, citing the "significant financial burden" facing the state because the "majority of existing water infrastructure has aged beyond its useful life." The ASCE estimates Oklahoma will need to spend 6.5 billion dollars on drinking water infrastructure over the next 20 years and another 1.3 billion on wastewater infrastructure. How can small communities improve their water infrastructure in the face of these daunting costs?

In 2008, the Water Center awarded a USGS 104(b) grant to Oklahoma State University professors Brian Whitacre and Art Stoecker from Agricultural Economics, and Dee Ann Sanders, Professor Emeritus of Civil Engineering, to work on potential solutions for this problem. Their study, titled *Decision Support Model for Evaluating Alternative Water Supply Infrastructure Scenarios*, used the USGS seed money to develop a model for rural water districts to find the best means to plan and update their water infrastructure. **The 2008 report specifically focused on the communities of Beggs, Braggs, Kaw City, and Oilton, OK.** For each of these four communities, the research team developed drinking water plans and alternative models to improve their water infrastructure.

All of the reports were favorably accepted by the communities, but "a lot of these communities have limited funds," Stoecker says. "So in addition to developing pipeline maps and water simulations, we also estimated costs for alternatives. In this sense it was a cooperation between economics and engineering."

To help make their proposed development plans more affordable, the research team also informed these communities about available funding. "There's some pretty hefty price tags associated with improving water infrastructure," Whitacre says, "so my role was to go to the Oklahoma Water Resources Board (OWRB) and other sources to find

grants and people who could help them apply for funds for these projects, to implement some of the suggested improvements."



Elevated water tower in Beggs, OK

While the primary aim of the study was to help these four communities find an appropriate plan to repair and update their water infrastructure, its usefulness extended much further. "I think it's a useful project, even outside of Oklahoma," Whitacre says. "A lot of rural communities simply don't have the manpower to do the kind of research and modeling we did with this grant."

The research team presented their findings to each of the four communities and to the OWRB. In addition, they presented their results at research conferences such as the Southern Agricultural Economics Association (SAEA) annual meeting, as well as a poster presentation at the Governor's Water Conference and Research Symposium, which spread their findings to a wider audience.

The impact of this particular USGS 104(b) grant is far-reaching, influencing water infrastructure for many rural communities beyond the four studied in this project. The decision-modeling systems and software these researchers developed can help Oklahomans adapt to their ever-changing water needs as we work toward updating and restoring our aging water infrastructure.

For more information about other USGS 104(b) grant studies, please visit <http://water.okstate.edu/library/reports/project-reports>.

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Excerpted from full article at <http://water.okstate.edu/library/impacts>.



## Noted scientist to speak at Oklahoma Governor's Water Conference and Research Symposium

(by Donald Stotts, Agricultural Communications Services)

An expert on groundwater flow and transport, well hydraulics and stream-aquifer interactions, Butler served as president, International Commission on Groundwater, International Association of Hydrological Sciences from 2013-2014.

"The conference is an unparalleled opportunity to hear from and interact with noted specialists in the field of water use, management and stewardship, such as Dr. Butler and others who will be providing insights on topics of importance to Oklahoma and beyond," said Garey Fox, director of the Oklahoma Water Resources Center.

"Each year, the latest developments in water management and quality, infrastructure financing, and many other related issues are addressed by state, federal, and local experts," Fox said. As for the scientific studies presented as part of the research symposium, Fox said people should not be hesitant to attend: A typical symposium session is a presentation by a researcher that is aimed at a lay audience. "The researchers understand most of their audience is not as familiar with the topic as they and so present it in appropriate terms," he said. "The idea is to communicate and educate so that people can make informed decisions. Presenting the material in a way that is understandable by non-experts is a key component."

One of the more popular aspects of the research symposium is the Student Poster Contest, wherein university students present their original research via posters. "Every year, participants tell us their interactions with these students are among the highlights of the event," said Fox, who serves as the Thomas E. Berry Endowed Professor in Integrated Water Research and Management with Oklahoma State University's Division of Agricultural Sciences and Natural Resources.

Additional information about this event is available online at <http://water.okstate.edu/activities/symposium/2015>.

Read the full article from [our Symposium page](#).

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## A Path Forward for Oklahoma's Groundwater Monitoring and Assessment (by Joshua Cross, OWRC staff writer)

It is commonly said that sound research and data leads to sound policy, and that phrase rings especially true for water resources. As recommended by the Oklahoma Comprehensive Water Plan, the state of Oklahoma is improving our understanding of groundwater as part of recently created Groundwater Monitoring and Assessment Program (GMAP). This program is comprised of approximately 750 monitoring wells in Oklahoma's 21 major aquifers sampled on a five-year rotation, and represents Oklahoma's first long-term aquifer-based sampling to be phased in by 2017. A recent presentation at the 2015 Oklahoma Governor's Water Conference and Research Symposium held December 1-2 in Norman highlighted the usefulness of such a monitoring and assessment program moving forward.

James J. Butler Jr., senior geohydrologist for the Kansas Geological Survey, presented a keynote titled, ***Assessing the Future of the High Plains Aquifer***. Butler demonstrated some of methods the Kansas Geological Survey has undertaken to measure groundwater level and use in the High Plains Aquifer in order to better predict future conditions based on their prior appropriation groundwater law system.

Butler's presentation focused on one significant portion of the High Plains Aquifer, the Ogallala. "The Ogallala Aquifer in western Kansas is under stress," Butler said. "In southwest Kansas, we have cumulative declines in water level of 60 to 70 feet since 1996."

Butler also noted significant declines in the saturated thickness of the aquifer since the onset of wide-scale pumping for irrigation. "In parts of Kansas, the Ogallala has lost up to 60% of the saturated thickness," he said. "We are in relatively dire straits in certain parts of Kansas," Butler said. "As that aquifer thickness diminishes, the ability of the aquifer to readily yield water to wells diminishes ... making it more expensive to bring water to the surface."

Butler attributes these declines in saturated thickness to increased groundwater use and low natural recharge, which has a significant impact on the agricultural industries. "These factors put stress on the agricultural community ...



Read the full article on [our Groundwater page](#).

# STUDENT SECTION:

## Are You an Undergraduate Interested in Research?

The Oklahoma Water Resources Center will be hosting an NSF-REU (Research Experiences for Undergraduates) on Stream Restoration/Rehabilitation in summer 2016.



The REU pays for student housing, meals, research supplies, and travel to a future conference. Students also receive a stipend during the 10-week program.

Learn more about this opportunity at <http://water.okstate.edu/students/nsf-reu>.

**Applications due 2/15/2016.**

[water.okstate.edu/students](http://water.okstate.edu/students)  
[water.okstate.edu/job-board](http://water.okstate.edu/job-board)

## Call for Abstracts:

### 2016 Student Water Conference

The 2016 Student Water Conference will be March 24-25 on the Stillwater campus of OSU. [More at <http://water.okstate.edu/students/swc>.]

Student presentations will be judged by a panel of faculty members for constructive feedback and awards. Student activities will promote interaction among students of all disciplines. Ty Ferre, Darcy Lecturer, will deliver the Buchanan Lecture.

Abstracts must be submitted at [water.okstate.edu/students/swc/abstract](http://water.okstate.edu/students/swc/abstract) by **January 15, 2016**.

The **2015 Governor's Water Conference and Research Symposium** took place 12/1-2.

Students and professionals presented their posters in a Cafe-Style session. Five students were recognized for their **Outstanding Poster Presentation**.



**2015 Water Research Symposium Outstanding Poster Contest winners**

*(l-r: Andres Patrignani, Briana Wyatt, Saroj Kandel, Holly Enlow, Curt Dikes)*

Poster and oral presentations are posted at <http://water.okstate.edu/programs/symposium/2015-symposium>.

[Join our mailing list](#) to receive notifications about next year's symposium.

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**[OSU Students Win Irrigation Foundation Awards](#)**

## Faculty Spotlight: Phillip Alderman

(by Phillip D. Alderman, Plant and Soil Sciences Assistant Professor)

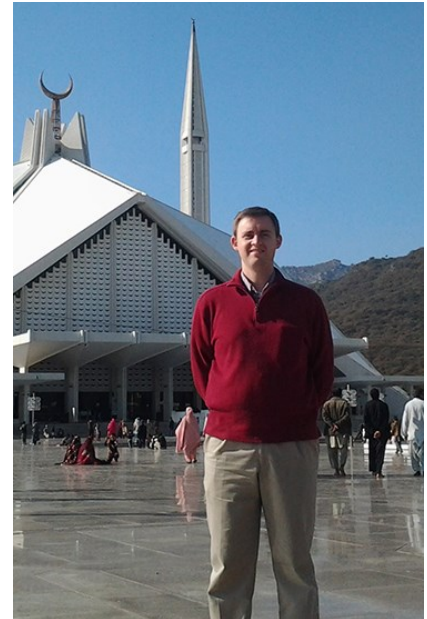
As the child of an Air Force officer, I had lived or spent time in eleven countries outside the US by the time I graduated from high school. These cross-cultural experiences prompted me to begin my academic career with a degree in Linguistics, an area that still fascinates me. Ultimately, though, I wanted to make more tangible contributions to human well-being, which led me to my current professional home within agriculture.

I joined the Plant and Soil Sciences Department faculty in July of 2015 as the new Agricultural Systems Modeler. In a nutshell, I use computer models to understand the fundamental processes that drive agricultural systems in order to design systems that are sustainable and resilient.

My past research experiences have ranged from modeling within-plant carbohydrate and nitrogen dynamics of forage bermudagrass to modeling long-term household livelihood and soil fertility dynamics in West Africa. Immediately before coming to OSU, I spent nearly three years at the International Maize and Wheat Improvement Center (known by its Spanish acronym CIMMYT), where I used models to quantify the effect of plant traits (such as deeper rooting) on wheat yield and sustainable water use across diverse environments.

I look forward to drawing on these experiences as I apply simulation modeling to answer questions of importance to Oklahoma. At present, I am focused on developing interdisciplinary modeling frameworks to assess climate risk and resilience of agricultural systems with fellow Oklahoma researchers through the [Oklahoma NSF EPSCoR](#) project on socio-ecological systems and climate variability. I always welcome new opportunities for collaboration, so contact me if interested.

On a personal note, my family and I have enjoyed getting to know the Stillwater community over the last few months and look forward to exploring more of Oklahoma's rich cultural and ecological diversity in the future.



Dr. Phillip Alderman

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## OSU Students Win Irrigation Foundation Awards

(by Joshua Cross, OWRC staff writer)

Two Oklahoma State University students were selected by the Irrigation Foundation as winners of the 2015 Irrigation E3 program. [Samia Amiri](#) and [Colton Craig](#) were among the 15 winners chosen from applicants across the nation, based on recommendations from faculty who nominate outstanding students for this distinction.

Amiri, a graduate student in OSU's Department of Biosystems and Agricultural Engineering, was nominated by Saleh Taghvaeian, BAE assistant professor. As a research assistant to Taghvaeian, Amiri conducts research on soil salinity issues in southwestern Oklahoma. "In this area, due to low quality of irrigation water and drought, the salt buildup in the soil is increasing," Amiri said. "Our objectives are investigating the current status of salinity in the area and finding the main contributing factors to the problem."

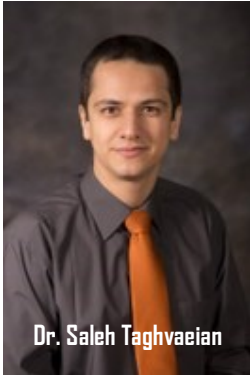
Craig, a landscape architecture student, was nominated by Lou Anella, horticulture and landscape architecture professor. "I've always wanted to be a golf course architect," Craig said. "I started drawing courses in crayon when I was five years old." In particular, Craig is interested in turf reduction plans. "Water scarcity is a very real thing," he said. "A lot of courses are starting to include turf reduction plans and introducing native grass areas that are drought tolerant."

As part of the award, Amiri and Craig received all-expenses-paid trips to Long Beach, California, to attend the 2015 Irrigation Show and Education Conference, as well as daily stipends for food and other amenities.

Read the full article, on [our Irrigation Practices page](#).



## In the News:



Dr. Saleh Taghvaeian

### **OSU awarded nearly \$775,000 for improving irrigation management**

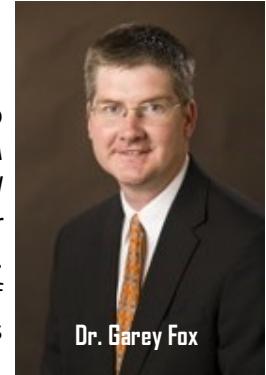
(by Sean Hubbard, 12/4/2015)

... for Extension efforts geared toward promoting sensor-based technologies for conserving agricultural water resources through more efficient irrigation management.. [\[Read more\]](#)

### **OSU's Garey Fox earns national notoriety as educator**

(by Don Stotts, 11/29/2015)

Dr. Garey Fox was one of two national recipients of the *USDA Excellence in College and University Teaching Awards for Food & Agricultural Sciences...* which honors the use of innovative teaching methods and service... [\[Read more\]](#)



Dr. Garey Fox

### **Cold, wet weather affects Southern Plains cattle operations**

(by Don Stotts, 11/30/2015)

Old Man Winter made an appearance, challenging producers with rain, freezing rain and even snow depending on where they live. [\[Read more\]](#)

### **El Nino influences on Oklahoma's upcoming wildfire season**

(by Sean Hubbard, 11/25/2015)

The dormant season, which occurs from November through early April in Oklahoma, usually sees the majority of fires on an annual basis. [\[Read more\]](#)



Dr. Lou Anella

### **OSU professor recognized for excellence in education**

(by Trisha Gedon, 11/10/2015)

Lou Anella, ornamentals professor in OSU's Dept. of Horticulture and Landscape Architecture, and director of The Botanic Garden at OSU, has been named the recipient of the 2015 Excellence in Education Award by the Irrigation Foundation. [\[Read more\]](#)



### **Valuing Recreational Fishing**

(by Max Melstrom, 9/9/2015)  
744,000 anglers take >7 million fishing trips in Oklahoma each year. With typical spending exceeding \$100 per trip, anglers contribute more than \$800 million each year to Oklahoma's economy. [\[Read more\]](#)

## **New Publications**

### **Extension Fact Sheets:**

Listed and linked at [water.okstate.edu/library/extension-fact-sheets](http://water.okstate.edu/library/extension-fact-sheets).

### **Journal Articles:**

Waiting for you at [water.okstate.edu/library/journal-publications](http://water.okstate.edu/library/journal-publications).

# New & Noteworthy

## Funding ([water.okstate.edu/faculty/funding](http://water.okstate.edu/faculty/funding))

- **DoD: Strategic Environmental R&D Program** (pre-props due 1/7/; full proposals due 3/8/16)
- **Army CoE: Engineer Research and Development Center** (due 1/31/16)
- **National Competitive Water Research Grants** (USGS 104(g); due 2/25/16)

## Employment (<http://water.okstate.edu/job-board>)

- [Dr. Saleh Taghvaeian](#) is looking for 3 **graduate students** to research sustainable agricultural water management and irrigation engineering ([view the announcement](#))
- Several **EPA** opportunities
- **Assistant Professor** in groundwater hydrology (UC, Riverside; open thru June 30, 2016)

## Events ([water.okstate.edu](http://water.okstate.edu))

- **Water Research Advisory Board meeting** (Stillwater, OK; 1/7)
- **Climate Adaptation Conference** (Minneapolis, MN; 1/28/2016)
- **OSU Research Week 2016** (2/15-19/2016)
- **Oklahoma Water Law Conference** (OKC; 2/29-3/1)
- **Great Plains LID Research and Innovation Symposium** (Omaha, NE; 3/7-9/2016)
- **Oklahoma Irrigation Conference** (3/8; Woodward County Event Center and Fairgrounds)
- **Oklahoma Research Day** (3/11/2016; NE State Univ. Event Center. Abstracts due 1/29; register by 2/10)
- **Student Water Conference** (Stillwater, OK; 3/24-25; abstracts due 1/15). This year's Darcy Lecturer and Univ. Arizona professor, Ty Ferre, will deliver the keynote address.
- **OK Clean Lakes and Watershed Association Conference** (Stillwater, OK; 3/29-30/2016)

## WWWeb Updates

- ◇ An [Animal Husbandry](#) page is available for those who care for cattle, horses, poultry, or swine.
- ◇ New No-Till, how-to, and Mesonet videos are in our [library](#).
- ◇ Be the first to know about the latest additions! [Subscribe to the RSS feed](#) or connect with us on social media.

## Connect



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