THE AQUAHOMAN

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The newsletter of the
OKLAHOMA WATER RESOURCES CENTER

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From the Director's Desk (by Garey Fox)

Dr. Garey Fox, Interim Director

We in the Oklahoma Water Resources Center have had a busy fall! Yet, facilitating collaborations and extending knowledge remain at the core of everything we do. To help us succeed in spreading the word about the various activities of the Water Center and its faculty, we have enlisted the help of a staff writer, Jonathan Anthony. Many of his articles are linked below.

Since the last *AQUAhoman* was published, we have hosted a number of keynote speakers during the fall. Recent presentations were made by Dr. Kendall DeJonge, USDA-ARS, on limited irrigation (more here); Dr. Jorge Escurra, ODAFF, on climate variability and modeling; and Dr. François Birgand, North Carolina State University, on high-frequency water quality data (video here). An upcoming presentation will be given by Dan Yates, Associate Director of the Groundwater Protection Council, and Ben Grunewald, Director of the Ground Water Research and Education Foundation (more on page 2). Let us know if you are interested in visiting and presenting a water topic at OSU.

The Illinois River Watershed Symposium announced in the last issue provided an opportunity for participants to get project updates and voice future needs in the watershed. View the symposium's press release here.

The 2014 Oklahoma Governor's Water Conference and Research Symposium was a tremendous success. In an effort to continually improve the content and delivery of research-based information at the research symposium, we made some small changes. Instead of poster displays, we held a Café-Style Poster Session, which was well received by all participants. We welcome any suggestions for improving the symposium.

Our invited speaker, Dr. François Birgand, is a researcher at North Carolina State University. He challenged Oklahoma to consider the importance of high frequency water quality data. Presentations, poster winners, and a video of Dr. Birgand's talk are on our Symposium page.

Six individuals represented OSU at the first Big 12 Water Workshop in Lawrence, Kansas. In fact, the state of Oklahoma through both OSU and OU was very well represented, including two keynote presentations in the morning session and faculty leading or serving as key participants in research/Extension discussion groups in the afternoon. Breakout groups discussed topics such as reservoir sedimentation,

("Director" continued on page 5)

Ground Water Protection Council: Purpose and Projects

(by Dan Yates, Associate Director of the Ground Water Protection Council)

The Ground Water Protection Council (GWPC) is a non-profit organization whose members consist of state agencies with groundwater regulatory or oversight functions. These agencies come together within the GWPC organization to mutually work toward the protection of the nation's ground water supplies. State agency members range from Departments of Environmental Quality, Natural Resources, Water Resources, and Oil and Gas regulatory agencies. The purpose of the GWPC is to promote and ensure the use of best management practices and fair but effective laws regarding comprehensive ground water protection. Our mission is to promote the protection and conservation of ground water resources for all beneficial uses, recognizing ground water as a critical component of the ecosystem. We provide an important forum for stakeholder communication and research in order to improve government's role in the protection and conservation of groundwater.

Current issues faced by GWPC members include aquifer storage and recovery, source water protection, hydraulic fracturing water usage, identification of alternative sources of drinking water, nutrient loading in groundwater, competing demands on groundwater, and cross program coordination such as highlighting synergies between Clean Water Act and Safe Drinking Water Act programs.

The GWPC's sister organization, The Ground Water Research & Education Foundation (GWREF) promotes and conducts research, education, and outreach, in the development and application of technical systems, pollution prevention efforts related to ground water protection, underground injection technology, and watershed conservation and protection. The Foundation's goals are to:

- Support the Ground Water Protection Council in the fulfillment of its mission to improve government's role in the protection and conservation of ground water.
- Identify and facilitate research aimed at increasing our understanding of the science and policy of ground water protection and conservation.
- Develop education and outreach initiatives which increase the level of understanding of ground water resources in order to empower citizens to assume ground water protection roles.
- Provide tools and resources for ground water protection and conservation practitioners to better fulfill their goals.

Two important projects GWPC has been involved in recently are the CWA-SDWA Coordination Toolkit and the report "State Oil & Gas Regulations Designed to Protect Water Resources."

The Toolkit is the result of a multi-year collaborative effort by state and EPA water quality managers across clean water and safe drinking water programs. The group drew on expertise and examples of success from many states to provide the most promising opportunities to address complex water quality challenges that could benefit from a coordinated and collaborative approach, leveraging all available tools and resources. GWPC and its member states participated on the sub-workgroups that wrote sections of this report. The Toolkit identifies opportunities to reduce pollution in drinking water sources by using CWA tools; provides examples of on-the-ground implementation; demonstrates how program managers can align their efforts to protect source water through a combination of actions and institutional relationships that facilitate cross-program coordination at the national, regional, state, and watershed scales to achieve common objectives; and shows how state clean water programs can leverage the high value that consumers place on public health protection and safe drinking water to increase public support for addressing surface and ground water quality challenges more effectively. View the toolkit at http://www.gwpc.org/cwa-sdwa-coordination-toolkit.

The *State Oil & Gas Regulations Designed to Protect Water Resources* is an update to GWPC's 2009 report and includes an overview of 2013 groundwater protection rules in 27 states that account for more than 98 percent of the country's oil and gas production. In addition to the most up-to-date accounting of state regulatory activities, the report includes a series of items states might consider when evaluating and revising their rules and policies regarding hydraulic fracturing, chemical disclosure, storage and spill prevention. This report is indicative of GWPC's effort to engage with state oil and gas programs in continuous regulatory improvements focused on groundwater protection. View the report at http://www.gwpc.org/state-oil-gas-regulations-designed-protect-water-resources-2014-edition.

View the events page for opportunities to hear more from Dan Yates.

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 this summer 2015 in Stillwater, Oklahoma.

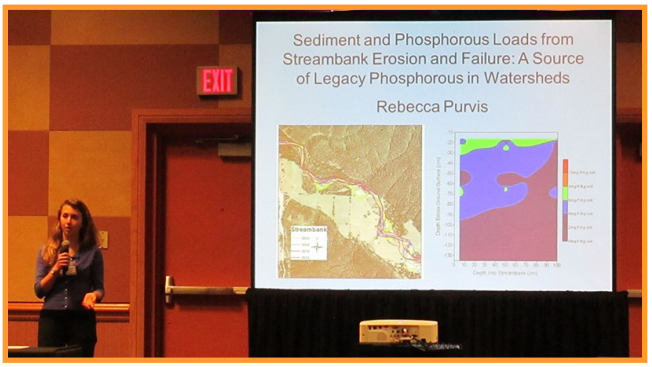
The REU pays for student housing, meals, research supplies, travel to a future conference, and also provides a stipend during the 10-week program this summer.

You can learn more about the projects and faculty mentors at http://studentwater.okstate.edu/content/nsf-reu-streams.

If you have questions about the REU, please don't hesitate to contact water@okstate.edu about this opportunity. Application deadline is 2/15/2015.

The **2014 Governor's Water Conference and Research Symposium** took place October 22 and 23 in Oklahoma City.

Students and professionals presented their posters in a Cafe-Style Poster Session.



Four students received an **Outstanding Poster Presentation Award.**

1. **Dani Glidewell** (OU undergraduate student)
2. **Brenda Allison** (OU graduate student)
3. **Rebecca Purvis** (OSU graduate student)
4. **Briana Sallee** (OSU graduate student)

Poster and oral presentations are posted at http://water.okstate.edu/programs/symposium/2014-symposium.

Join our mailing list to receive notifications about next year's symposium.

Call for Abstracts: 2015 Student Water Conference

The Oklahoma Water Resources Center will be hosting an Student Water Conference March 26-27, 2015 on the campus of Oklahoma State University in Stillwater, Oklahoma.

The conference will consist entirely of student presentations to be judged by a panel of faculty members for providing constructive feedback to students in regard to their research presentation skills. Awards will be given for outstanding student presentations. Also, student activities will promote interaction among students of all disciplines.

Abstracts can be submitted through the on-line Abstract Submission Form found at http://studentwater.okstate.edu/content/swc and are **due by January 9, 2015**.

OKLAHOMA WATER RESOURCES CENTER

The Widespread Impact of the Water Center's Grants Program

(by Jonathan Anthony, OWRC staff writer)

The USGS 104(b) grant is like a seed planted in promising soil. With time and attention, it can grow to build a strong foundation and bear fruit on each of its different branches. For example, one branch could hold a published article, a network of colleagues and collaborations, or a microphone used to deliver dozens of presentations to inform the public.

Formerly known as the Oklahoma Water Resources Research Institute (OWRRI) grant program, the USGS 104(b) grant is funded through the Water Resources Research Act. The purpose of this grant is to fund promising small-scale research focused on Oklahoma's water resources. As time passes, the funded project grows to produce information to support the future research needs of Oklahoma. Beyond that, it benefits the community as a whole through student education, new collaborations, and expanded public knowledge.

In 2007, the USGS 104(b) grant was awarded to Tracy Boyer, Associate Professor in the Department of Agricultural Economics Department at Oklahoma State University. Boyer's research served as a case study of tradeoffs between market and non-marketed uses of water at Lake Tenkiller to determine the optimal management protocol for the next 50 years. "Dams were originally created for hydropower and floods," Boyer said, "but recreation is significant for rural income and the users themselves. Our results show a 1:78 ratio of increased benefits to society of maintaining the reservoir to optimize for recreation as well as hydropower and flood control. If you don't manage for recreation, you're going to lose all of those non-consumptive recreational values."

After the study completed in 2008, its influence expanded into the foundation for Boyer's later survey of Oklahoma's Fort Cobb Reservoir as part of a research team funded through a USDA National Integrated Water Quality Program grant in 2014. With Larry Sanders and Art Stoecker, both professors in agricultural economics, Boyer conducted a baseline survey of recreation within Fort Cobb Reservoir to study the relationship between erosion control and water conservation in the summer of 2014. "From our past experiences at Lake Tenkiller, we have learned a lot about conducting recreational surveys and how to approach lake users," Boyer said. They are also currently conducting a mail survey of agricultural soil and water conservation practices with agricultural producers in the Ft. Cobb Watershed.

Through the USGS 104(b) grant funding, Boyer produced a published article in the Journal of Water Resources Planning and Management, with more articles and fact sheets in development. Her two graduate students, Debnath Deepayan and Phumsith Mahasuweerachai, each completed doctoral theses based on the applied research in Lake Tenkiller. After completing their Ph.D degrees, Deepayan became a Professional Biofuel and Agricultural Commodity Market Analyst at the University of Missouri Columbia and Mahasuweerachai became an assistant professor at Khon Kaen University in Thailand.

The USGS 104(b) grant also helped the research team build ties with the Army Corps of Engineers, extension faculty, the Cherokee Nation, and the Oklahoma Scenic Rivers Commission, the latter of which provided several opportunities to present the value of recreation to policy makers. Boyer noted these presentations are still ongoing in late 2014, years after the study completed. "I was recently invited to speak to the legislature on the role of scenic rivers by the head of the Oklahoma Scenic Rivers Commission, Ed Fite," Boyer said, "and I used the research that arose from this grant as evidence of the different values of the uses of the Illinois River and Lake Tenkiller."

Dr. Boyer and extension faculty also apply the findings at a variety of conferences and meetings to inform the public about the consequences of not managing for multiple competing uses for water, including recreation. These presentations included the 29th Annual Governor's Water Conference and 6th Annual OWRRI Water Research Symposium, the North American Lake Management Soci-

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ety Meetings, the Oklahoma Clean Lakes and Watersheds Association Conference, and the Cherokee National Water Conference.

"Though it's difficult to quantify," Boyer said, "we believe that the data from the recreational values have been used widely by nongovernmental organizations that are trying to make sure their recreational values are counted in the state of Oklahoma. For example Charlette Hearne, president of the Oklahomans for Responsible Water Policy (ORWP), has used the value of $95/day per trip for Lake Sardis in numerous public policy hearings about using Sardis water for Oklahoma City."

Like Dr. Boyer, faculty that are awarded the USGS 104(b) grant funding use this seed money to build a large network of investigation and information to help the state of Oklahoma. If you are one of these grant recipients, please let us at the Oklahoma Water Resources Center hear your progress.

(Continued from page 1)

nutrient management, water/energy nexus, ecohydrology and environmental flows, and water reuse and conservation. The workshop will lead to the publication of a series of review articles on important water issues, and several potential collaborative proposals were identified by some of the discussion groups.

The Water Center is very excited about the release of a new video series on water! The video topics were identified from a survey of county extension agents across Oklahoma. This playlist will introduce you to the Water Center, surface water and groundwater hydrology, and irrigation methods for farmers and homeowners. Stay tuned for future videos on water rights, water quality, the Oklahoma Mesonet, and many others.

Finally, I am pleased to present the second in a series of grant impact statements developed by the Water Center and our staff writer, Jonathan Anthony. This impact statement (on page 4) highlights how the USGS 104(b) grant program helped Dr. Tracy Boyer, associate professor in agricultural economics, explore recreational benefits of Lake Tenkiller. Because of this project, Dr. Boyer recently testified to an interim legislative study committee in Oklahoma the reasons for protecting Oklahoma Scenic Rivers. It is truly amazing the impact of this grant program on water research, outreach, and education in Oklahoma!

The OWRC has added a new playlist, "Foundations of Oklahoma Water." Links below will connect you to the new videos.

Intro to the Oklahoma Water Resources Center | **Surface Water in Oklahoma** | **Groundwater in Oklahoma** | **Crop Irrigation Methods** | **Home Irrigation**

OSU Research Team Investigates Streambank Erosion and Phosphorus Sources

(by Jonathan Anthony, OWRC staff writer)

To protect water quality in eastern Oklahoma streams, OSU researchers are studying sources of phosphorus in the nearby land and ways to curb them. One research project led by Dr. Garey Fox explored phosphorus concentrations in the soil and streambank erosion in the Barren Fork Creek (BFC) watershed.

The BFC watershed is home to a regional poultry industry that generates a substantial amount of litter. Because it is expensive to ship, poultry litter is often sold to nearby farmers as fertilizer. Phosphorus accumulates in the soil, which can wash into streams as sediment. Excess phosphorus collecting in streams reduces water quality.

Streams in the Barren Fork Creek watershed have composite streambanks made of a sandy or silt-loam topsoil overlaying an unconsolidated gravel layer. When a bank's gravel layer is undercut by the streamflow, it can fail rapidly. This erosion can steal acres of property annually. The combination of phosphorus-laden sediment washing into streams and large-scale streambank erosion is proving to be a serious environmental issue.

Dr. Fox explained that his team prioritized streambanks because they "can represent a majority of the sediment and nutrient loads" for the watershed. In extreme cases, streambanks can account for "as much as 80% of the total sediment load," making them a clear choice for investigating phosphorus sources.

Oklahoma emphasizes and invests in riparian protection as a best management practice throughout the Illinois River watershed. A protected riparian zone has a strip of plant life growing alongside its streambanks, and reduces erosion through the additional soil strength that plant roots provide. Composite streambanks tend to be weaker because roots only hold onto the upper soil layer and leave the gravel beneath vulnerable to erosion. The team tested the effectiveness of riparian protection on this more volatile type of streambank. If proven beneficial, the research could support future installation of buffers or filter strips.

Of the ten areas studied, seven had a protected riparian zone, three were unprotected, and all ten were classified as eroding. The researchers surveyed each area in detail and used three methods for evaluation: aerial images from the National Agricultural Imagery Program (NAIP) taken in 2003, 2008, and 2010 to quantify erosion of the streambanks; detailed phosphorus analysis with 253 soil samples to determine streambank phosphorus concentrations; and filmed reconnaissance from helicopter flights over the Barren Fork Creek to determine streambank erosion and failure throughout the watershed.

NAIP images showed streambank erosion occurred at nearly every site—most prominent at sites without a historically protected riparian zone. Sites with riparian protection still eroded, but at slower rates than the unprotected banks. Phosphorus levels appeared to be related to the distance from the Illinois River; closer sites had higher levels. It is likely that the sandier upstream soils were not as buffered for phosphorus as the silt-dense downstream soils, creating an extra variable in the study.

Approximately 29% of soil samples had phosphorus levels high enough to be of environmental concern from immediate phosphorus loading if the streambank erodes. With a combination of soil analysis and video reconnaissance, the team determined that more than a third of the Barren Fork Creek watershed has unstable banks that likely provided 10% of the estimated dissolved phosphorus load.

The team observed streambanks with riparian buffers have "three to four times less sediment and phosphorus" entering the stream. Dr. Fox summarized that the results give quantifiable evidence for the value in riparian protection.

Installed and maintained riparian buffers are important for reducing property loss due to erosion, filtering out pollutants before they reach the stream, and shading stream channels; all of which improve water quality and aquatic habitat. Landowners may receive financial and technical assistance for the installation of riparian buffers from the Conservation Reserve Enhancement Program (CREP) or the Environmental Quality Incentives Program (EQIP). You can learn more about the CREP program here and about the EQIP program here.

New & Noteworthy

Conferences/Seminars

- **Ground water conversation** in Stillwater, OK, 12/4/2014
  Dan Yates from the Ground Water Protection Council and Ben Grunewald from the Ground Water Research and Education Foundation will present a seminar about their organizations' missions and needs.
- **WRAB meeting** in Stillwater, OK, 1/8/2015
- **Joint Meeting of OK chapters of the AFS and TWS** in Tulsa, OK, 2/11-13/15
- **"Frontiers in Environmental and Water Management" International Conference** in Kavala, Greece, 3/19-21/2015
- **Student Water Conference**, Stillwater, Oklahoma, 3/26-27/2015

Job openings (water.okstate.edu/opportunities/employment)

- **Postdoctoral Research Associate** (USDA-ARS) in Stillwater, Oklahoma.
- **Assistant Cooperative Extension Specialist** in Water Resources & Climate Change Adaptation (UC, Berkeley)
- **Post-Doctoral Researcher** (The University of Arkansas, Fayetteville)

More information about these events and others is available at http://water.okstate.edu.

WWWeb Updates

◊ The Home page has a new slideshow of hot topics. (http://water.okstate.edu)

◊ The first phase of the Illinois River Watershed Activities web page is complete. This page will serve as the clearinghouse for all research and Extension projects in this important watershed. (http://water.okstate.edu/IRW)

◊ New opportunities are posted frequently. (http://water.okstate.edu/opportunities)

◊ New videos go online weekly on our video page.

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